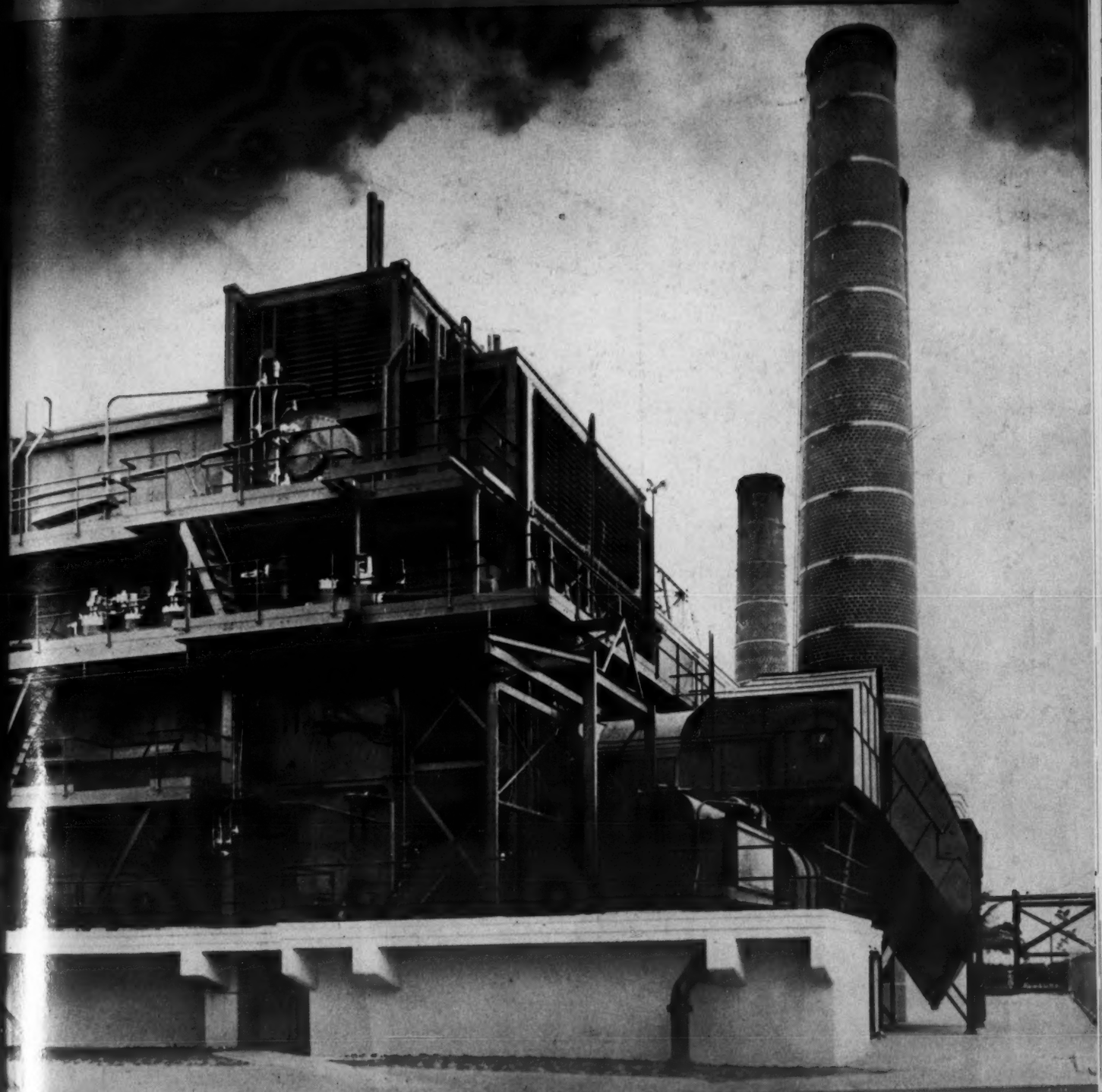
Electrical World

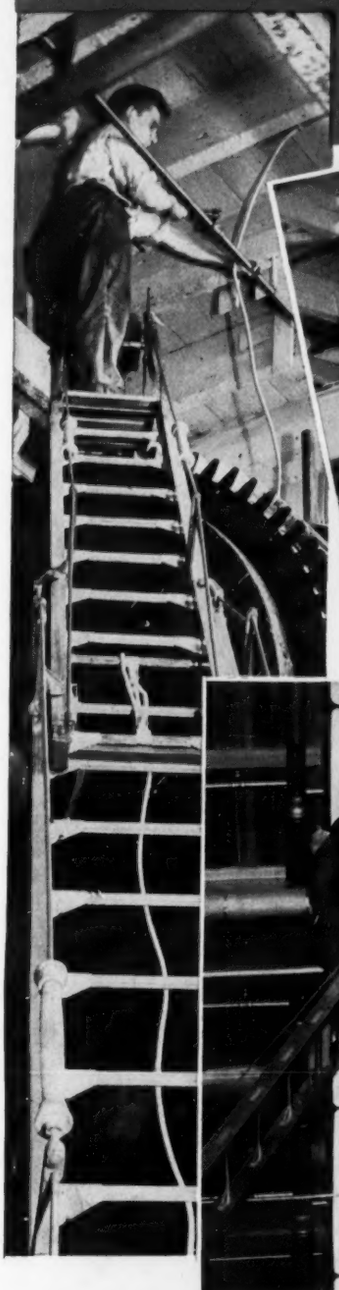
MARCH 20, 1943

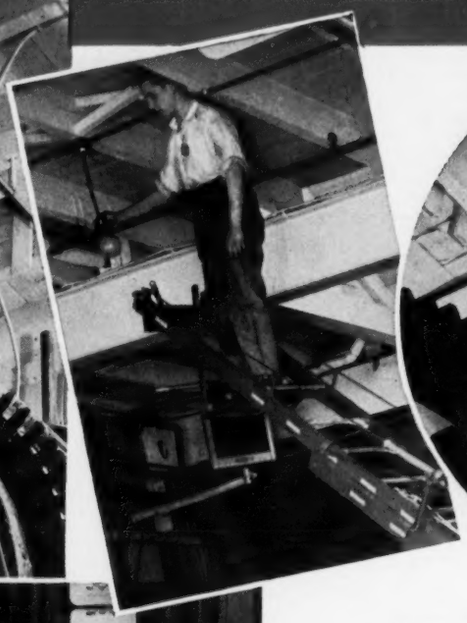


NO SACRIFICE IN THERMAL ECONOMY IN OUTDOOR PLANT

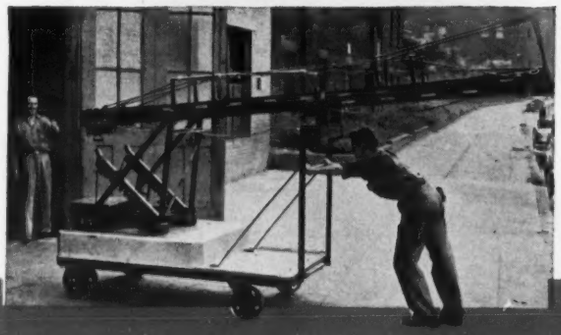
Easy overhead servicing - without stops—in vital war work!

Here's speed! Here's safety! Here's economy!





FAST SERVICING of indoor, high-overhead fluorescents, sprinkler heads or "what-have-you"—without stopping production, even where aisles are narrow—is accomplished with ease by reaching over bench or machine. Murray Crows'nests mounted on caster trailers or electric platform trucks are the last word in adaptiveness. Send for the convincing facts that have made this aerial ladder favorite among utilities for more than a decade. No obligation. Metropolitan Device Corporation, Brooklyn, New York.



INDOOR—OUTDOOR

Murray crows'nest

FOR MOUNTING ON CASTER TRAILERS, ELECTRIC PLATFORM TRUCKS OR STANDARD COMMERCIAL TRUCKS (½ TON OR LARGER)

Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 69 YEARS

March 20, 1943 — Vol. 119, No. 12

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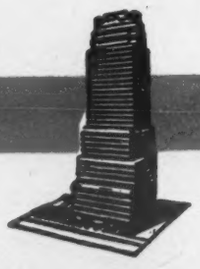

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330 West 42nd Street, New York, N. Y.

Director of Circulation:
Please change my address on Electrical World

From .....

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To .....

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Signed .....

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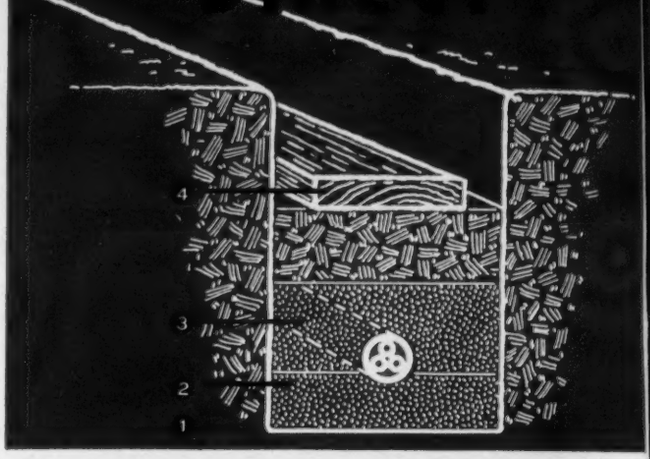
This is the Way to Install Cable WHEN BURYING DIRECT



While certain types of underground cable for direct burial are often plowed in, when installing the more expensive high tension cables, or cables for extremely critical circuits, further precautions will prolong their useful life and prevent service interruptions caused by mechanical damage, regardless of the type of insulation and covering used.

HERE'S HOW IT'S DONE:

❶ Dig trench deep enough (at least 18-in.), so cable will not be disturbed by plowing, surface digging or paving excavation.

❷ It is preferable to lay a sand cushion, or at least have base of trench loosened so it is cleared of rocks and other rough projections.

❸ After laying cable and before backfilling, cover it with soft earth or sand, free from stones, rocks, etc., so they won't press against the cable when flooding or frost-heaving disturbs the surrounding earth.

❹ A creosoted plank or concrete slab, laid six to eight inches above the cable, gives additional protection and warns workmen of its presence when digging over the cable.

Under highways and railroad rights-of-way, it is usually best to pull the cable through a pipe or conduit.

Such protection is particularly desirable for non-metallic underground cable. But even when metallic-armored (steel taped, etc.) cable is used, it is desirable to have this more complete protection. Naturally, the extent of protection depends upon the type of soil as well as the likelihood of disturbance, such as in urban areas where the majority of digging and excavating occurs.

Here's why these preventative measures increase the life of cable:

a Rocks and other sharp projections will not bruise or deform the cable insulation if extraordinary pressures develop.

b Better packing permits improved heat dissipation and paves the way for longer cable life and greater efficiency.

Hazard engineers are experts in the production, installation and maintenance of electrical wires and cables. Why not consult them about *any* cable problem?

Even the best installation practice does not help much unless the original cable is properly designed. To relieve any doubt specify:

HAZARD INSULATED WIRE WORKS
DIVISION OF THE OKONITE COMPANY
Works: Wilkes-Barre, Pennsylvania
Offices in Principal Cities

3226

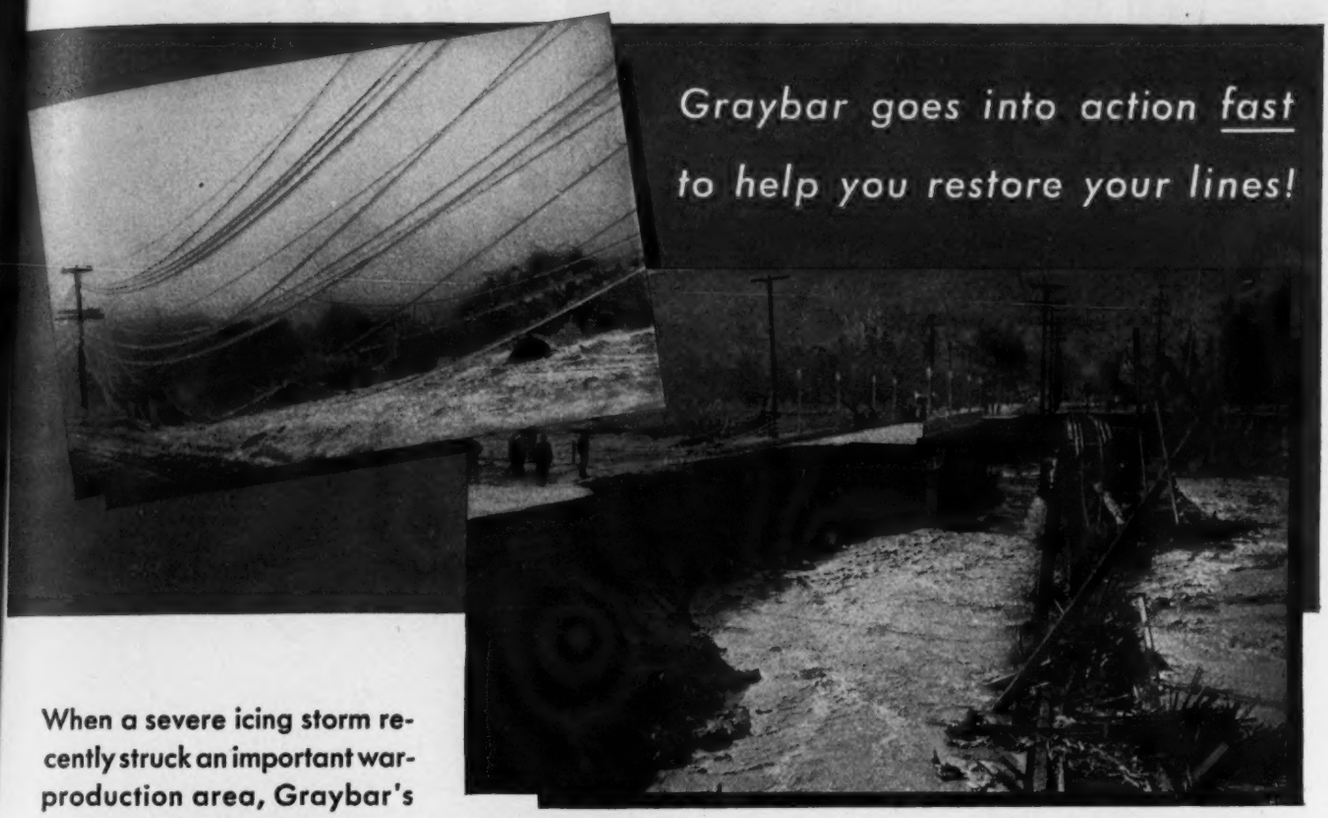
Hazard Armortite non-metallic underground

HAZARD ARMY E NAVY

Electrical Wires and Cables

Hazard lead and steel-taped Parkway

"Come Hail or High Water..."



When a severe icing storm recently struck an important war-production area, Graybar's local warehouse staff was in action *before dawn*. The first truckload of emergency pole-line supplies moved out to the point of greatest need at 7:30 that morning . . . less than two hours after the emergency call had reached the Graybar manager at his home.

Fast action of this sort is not exceptional with Graybar, and it goes deeper than a mere *desire* to serve you well. Out of the experience obtained in previous storms, floods and other emergencies, such as the New England hurricane, Graybar has learned lessons of advance planning. Even under today's limitations on warehouse stocks, available supplies are located so as to stretch their value as "emergency insurance". Graybar's "distribution network" acts like a power network to meet the demands of an area that's badly hit.

HOW YOU CAN HELP

To get the full benefits of this emergency service under war conditions, it pays to establish close contact with your Graybar Representative right now, before trouble strikes. Thus, dangerous scarcities can be foreseen, substitutes or alternates considered, and duplication of effort avoided. When the call comes for *action*, Graybar will be ready to roll without the need for detailed instructions. Why not talk the matter over with Graybar today?

GraybaR

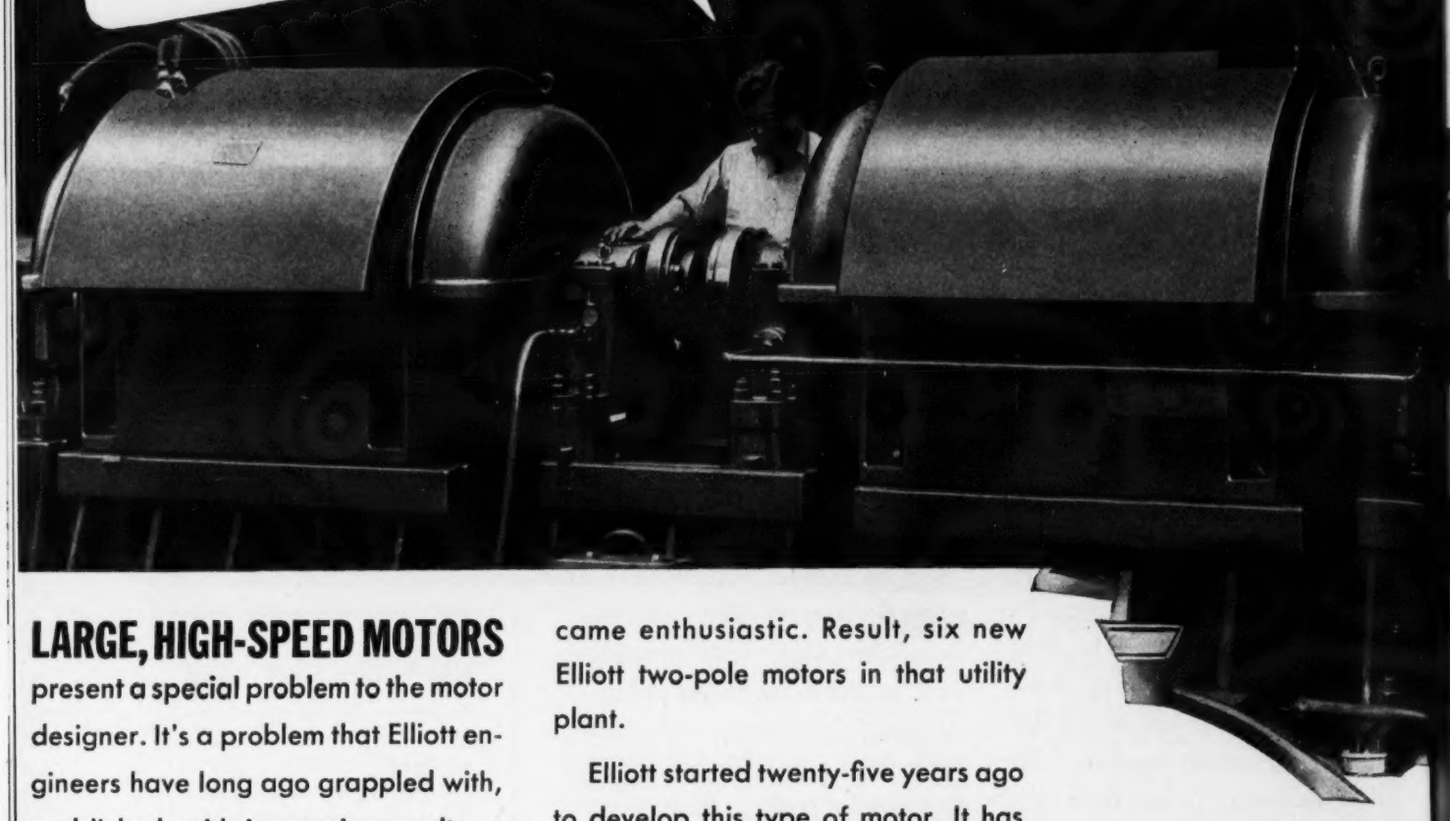
IN OVER 80 PRINCIPAL CITIES

GraybaR QUALITY SINCE 1869 * REG. U.S. PAT. OFF.

Everything Electrical . . . . THAT IT TAKES TO WIN!

Executive Offices: GRAYBAR BUILDING, NEW YORK, N. Y.

HUSKY is the word for these babies!



LARGE, HIGH-SPEED MOTORS present a special problem to the motor designer. It's a problem that Elliott engineers have long ago grappled with, and licked, with impressive results.

Take the two big motors in the picture — 2000-hp., two-pole induction motors. Impressive in appearance alone, so that a visitor representing a prominent utility, seeing them in the Elliott shops, immediately became interested, watched the tests and became enthusiastic. Result, six new Elliott two-pole motors in that utility plant.

Elliott started twenty-five years ago to develop this type of motor. It has been a step-by-step process, like all engineering developments. The consequence of this concentration on a specialized motor problem is the rapidly increasing appearance of the familiar Elliott monogram on the bearing caps of fine big motors on high-speed utility drives.

ELLIOTT COMPANY

Electric Power Dept.

RIDGWAY, PA.

DISTRICT OFFICES IN PRINCIPAL CITIES

L-741A

Elliott motors of this type have a number of excellent points. Stator frames are stiffly constructed of welded steel, or cast if desired. Pressure lubrication from a built-in unit. Cool, quiet operation insured by large ventilating channels and ducts in both shell and stator core. Exceptionally high strength and rigidity at high speeds. Descriptive bulletin on request.

It's **ELLIOTT** for big, high-speed induction motors

CHECK THE FACTS on R&IE Products

Hi-Pressure, annular, silver line contact hinge. Constant contact maintained in all blade positions and keeps out dirt.

Braced, multiple blade in all sizes - for strength, rigidity and proper radiation.

Hi - Pressure, self-cleaning, silver spot contacts eliminate contact resistance.

Large hook eye —easy to hit. Positive blade latch with quick acting blade pry-out feature.

Individual pressure springs assure uniform contact loading.

Type **HPS** *Outdoor*

All service requirements have been met with generous use of material and well fitted, accurate workmanship. Built in all voltages, in all current capacities, and on any NEMA standard insulator.

ILWAY AND INDUSTRIAL ENGINEERING CO. GREENSBURG, PA.

In Canada—Eastern Power Devices, Ltd., Toronto

ENGINEERING AN
PRODUCTION

•

COMPLETE
SUBSTATION

•

OPERATING
MECHANISMS

DISCONNECTIN
SWITCHES

•

AIR BREAK SWITC

•

CONNECTOR

•

BUS CLAMP

•

CUTOUTS

•

THERMO-RUPTE

•

METAL HOUS
ISOLATED E

•

AUTOMATIC
THROW-OVE
EQUIPMENT

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METAL CUBICL

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INTERLOCK

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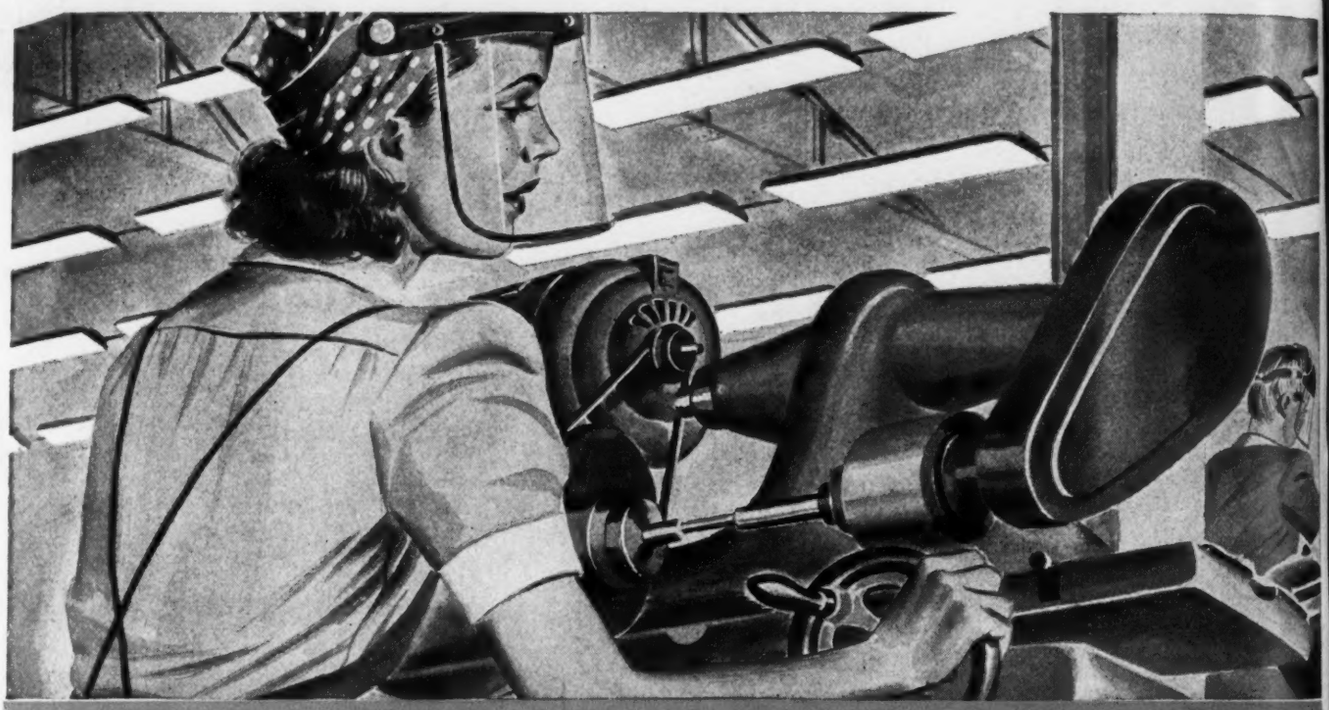
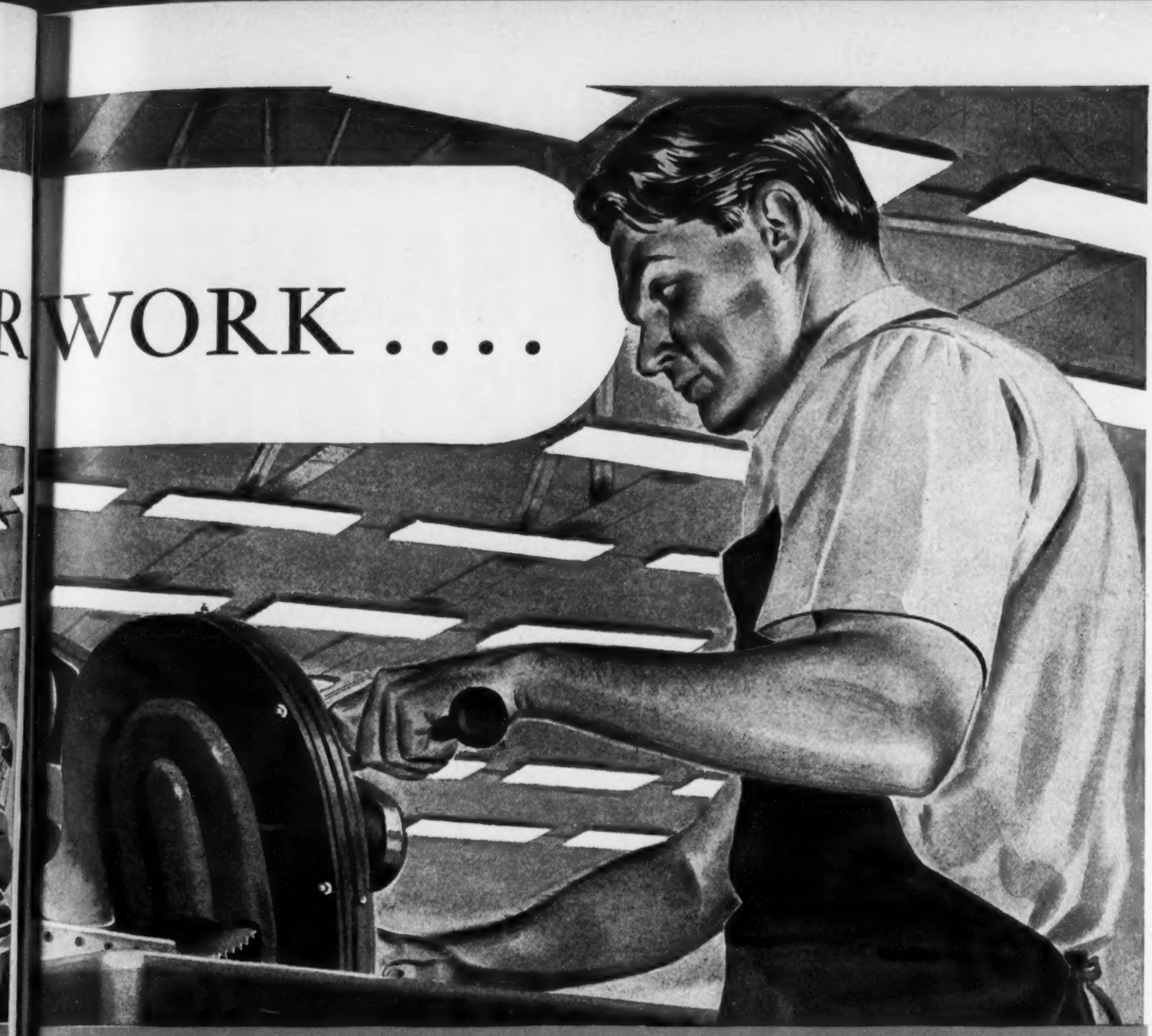
TESTING DEVI

"SEE-ABILITY" FOR WAR



The No. 1 job for the lighting industry in 1943 is to conserve critical materials, copper, tungsten, mercury and other materials needed not only in the manufacture of lamps and in lighting, but in other vital parts of our war effort. Our job is to make the most of the materials we have. First, by helping war industries get the most out of their present lighting equipment. Second, by aiding in the conservation of lamps wherever possible.

"SEE-ABILITY" helps increase war production



With this objective, Westinghouse introduces a new idea in lighting—"See-ability." In these two words are summed up the advantages of good lighting. Today, this idea is directed toward conservation—showing how to get the greatest "See-ability" from present equipment. Tomorrow, this idea will be directed to show the benefit of "See-ability" in stores, factories, homes, offices and highways. Westinghouse Electric & Mfg. Co., Lamp Division, Bloomfield, N. J.

Westinghouse

★ MAZDA LAMPS ★

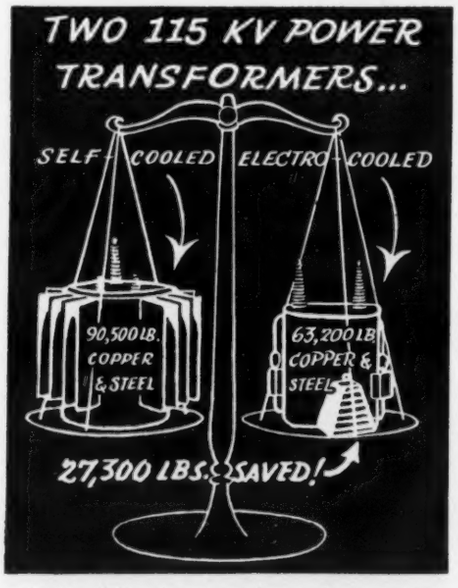
FOR GREATER "SEE-ABILITY"

ADD SENSATIONAL NEW YOUR ALLIS-CHALMERS ..AND ADD UP TO 60%

★ New ELECTRO-COOLERS can step up the capacity of most transformers now in service by 20 to 60%. Installation is quick, simple!

★ Allis-Chalmers' new ELECTRO-COOLER is self-contained and self-supporting...employs no stuffing boxes...is self-lubricating. Here's the coming thing in forced-oil cooling—a sound long-term investment!

★ New transformers built with Allis-Chalmers ELECTRO-COOLERS use 25% less copper and steel...cost correspondingly less!



Savings like these can be made on every contemplated power transformer!

HERE'S important news for hard-pressed systems: if your transformers are peak-loaded — and you still face increasing loads — there's a new unit designed to *jump* transformer capacity . . . the new Allis-Chalmers ELECTRO-COOLER!

On most transformers, the new ELECTRO-COOLER can step up capacity 20 to 60%!

And if you have Allis-Chalmers transformers equipped with radiator valves in service, new ELECTRO-COOLERS can be added without even removing the oil!

New foundations are not required . . . there's no need to shift transformers. ELECTRO-COOLERS are self-contained and self-supporting!

Don't confuse this new ELECTRO-COOLER with adaptations of air-conditioning devices. From top to bottom, it's engineered specifically for forced-oil cooling. Here's a wartime investment with a great peacetime future!

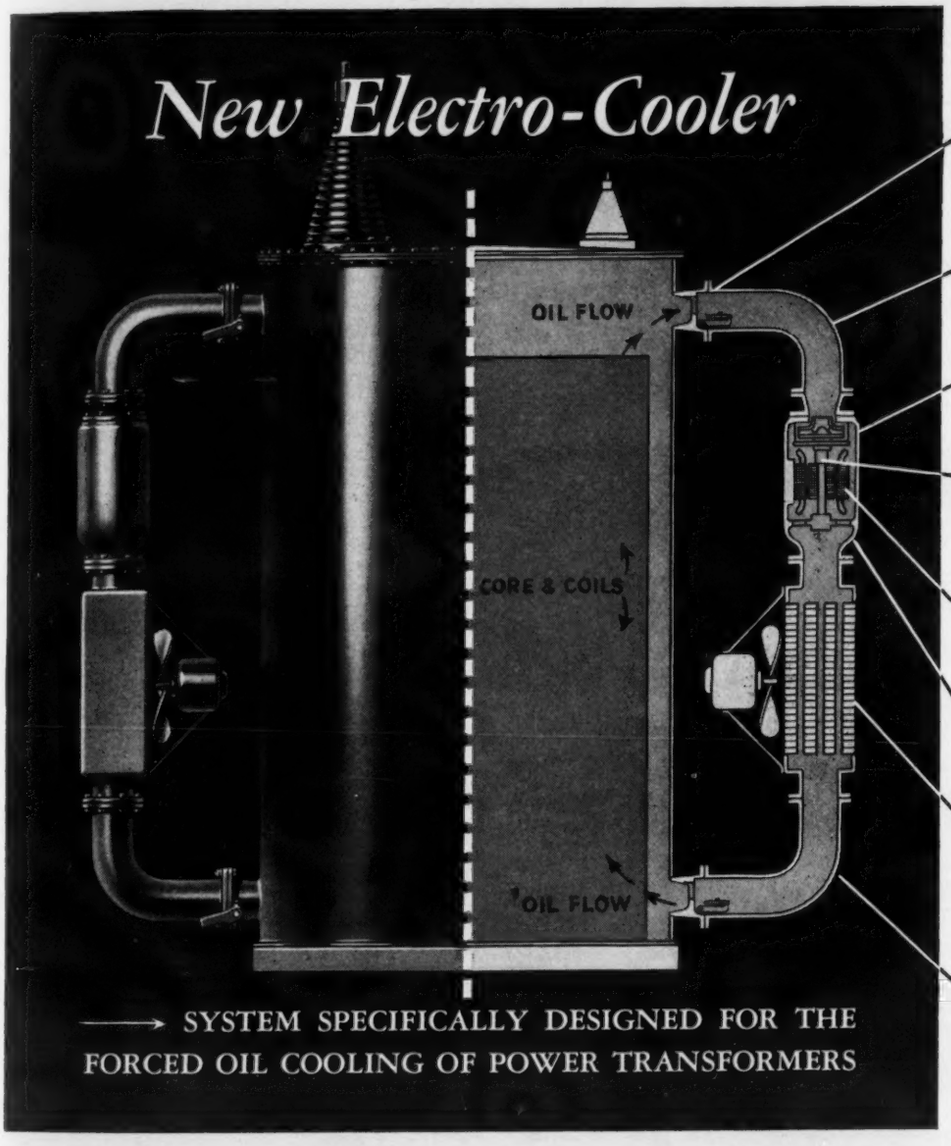
Applied to new transformers, the new ELECTRO-COOLER reduces copper and steel needed by about 25%. Added to existing transformers, it saves up to four times its own weight in scrapped radiator steel!

Today, get the full story on how the new ELECTRO-COOLER can solve wartime problems of *your* system. Write for Bulletin B6242 — and contact your nearby district office. ALLIS-CHALMERS MFG. CO., MILWAUKEE.

A 1565

ALLIS-CHALMERS

ELECTRO-COOLERS TO POWER TRANSFORMERS TO THEIR CAPACITY!


New Electro-Cooler
OIL FLOW
CORE & COILS
OIL FLOW
SYSTEM SPECIFICALLY DESIGNED FOR THE FORCED OIL COOLING OF POWER TRANSFORMERS

HIGHLIGHTS

EASILY INSTALLED or removed—*without* shifting the transformer. If the transformer has radiator valves, there is no need even to drain the oil!

FACTORY SEALED! No pipe connections or joints to be made in the field. ELECTRO-COOLER is factory-assembled as a unit.

NO GLANDS or stuffing boxes! Oil drips and air bubbles are eliminated—nor is there any need to replace or fix packing.

ONLY ONE SHAFT! Motor and pump are designed as a complete unit — on one shaft and in one frame. Result: greater mechanical strength, fewer parts, fewer mechanical fits.

SIMPLICITY! The three-phase squirrel cage motor has no starting brushes, commutator, or other such wearing parts.

SELF-LUBRICATED motor and pump are totally enclosed and immersed in oil.

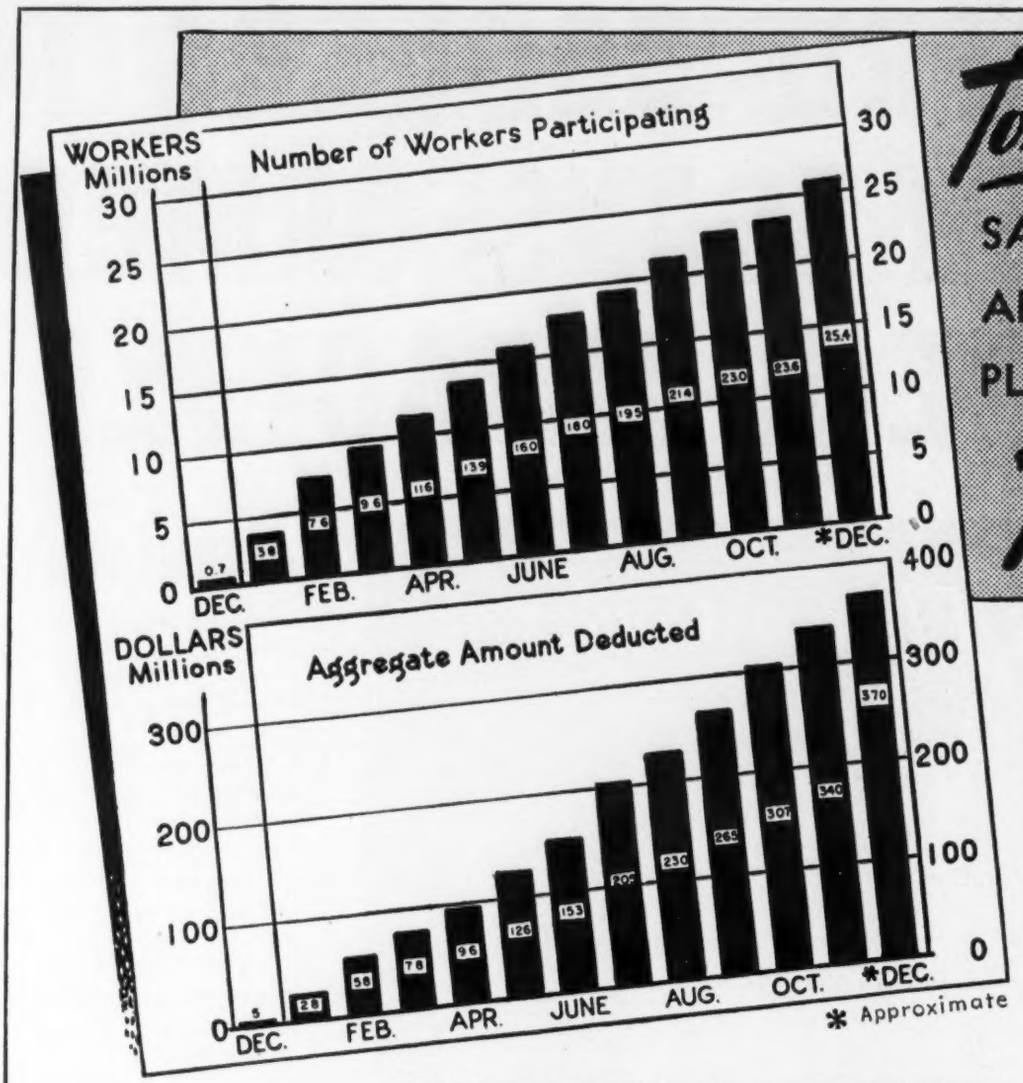
HIGH-PRESSURE TESTED! Possibility of oil leaks or seepage is eliminated by testing the ELECTRO-COOLER at 50 pounds pressure. Maximum working pressure is only a few pounds.

SELF-CONTAINED and self supporting! The new ELECTRO-COOLER required no foundations, no piping, no connections.

TRANSFORMERS

A-C ALLIS-CHALMERS MILWAUKEE

WE WORK FOR VICTORY WE PLAN FOR PEACE



Tomorrow's SALES CURVES ARE BEING PLOTTED . . . Today

THESE CHARTS SHOW ESTIMATED PARTICIPATION IN PAYROLL SAVINGS PLANS FOR WAR SAVINGS BONDS (*Members of Armed Forces Included Starting August 1942*)

STUDY THEM WITH AN EYE TO THE FUTURE!

There is more to these charts than meets the eye. Not seen, but clearly projected into the future, is the sales curve of tomorrow. Here is the thrilling story of over 25,000,000 American workers who are today voluntarily saving close to FOUR AND A HALF BILLION DOLLARS per year in War Bonds through the Payroll Savings Plan.

Think what this money will buy in the way of guns and tanks and planes for Victory today—*and mountains of brand new consumer goods tomorrow.* Remember, too, that War Bond money grows in value every year it is saved, until at maturity it returns $4 for every $3 invested!

Here indeed is a solid foundation for the peace-time business that will follow victory. At the same time, it is a real tribute to the voluntary American way of meeting emergencies that has seen us through every crisis in our history.

But there is still more to be done. As our armed forces continue to press the attack in all quarters of the globe, as war costs mount, so must the record of our savings keep pace.

Clearly, on charts like these, tomorrow's Victory —*and tomorrow's sales curves*—are being plotted today by 50,000,000 Americans who now hold WAR BONDS.

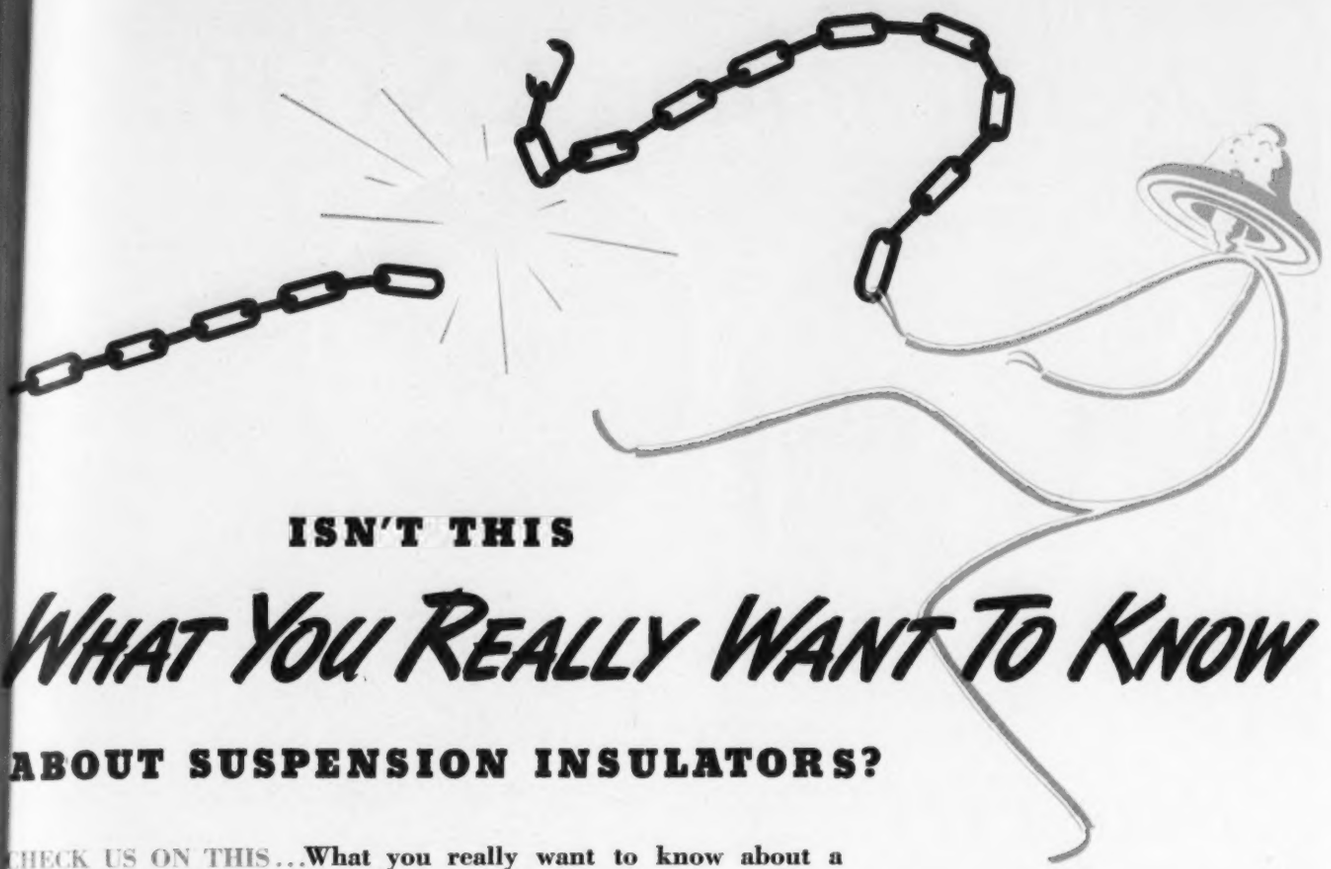
EVERYBODY EVERY PAYDAY AT LEAST 10%

Save with

War Savings Bonds

This space is a contribution to America's all-out war effort by

ELECTRICAL WORLD



ISN'T THIS

WHAT YOU REALLY WANT TO KNOW

ABOUT SUSPENSION INSULATORS?

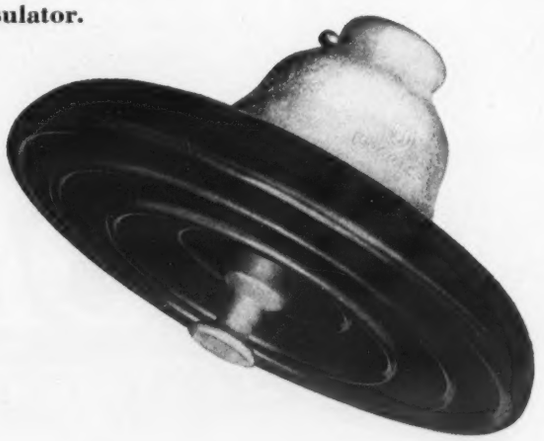
CHECK US ON THIS...**What you really want to know about a suspension insulator string is not how strong is the strongest unit, but how *weak* is the *weakest.***

A few extra strong units won't impart any of their strength to a weak one.

This all adds up to the fact that average strength is not a significant quality in your selection of a suspension insulator. The few super-strong units that bring up the average to some impressive figure don't help the weak ones.

O-B suspension insulators are sold on the basis of specific strength. Each cap bears a strength marking. This is *not* an average. This is the load below which not one insulator in a string or a carload will fail. There will naturally be some strength variations, but they will all be above the rated value, not on both sides of it.

O-B tells you *what you want to know* about a suspension insulator. We give you a strength rating that really counts, because you can *count* on it.



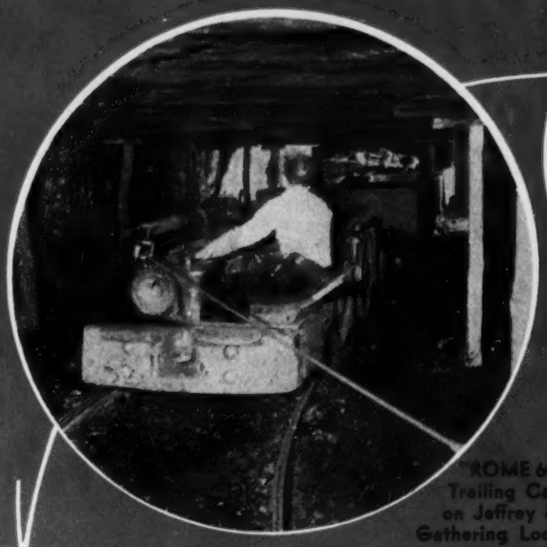
2401-H

Ohio Brass

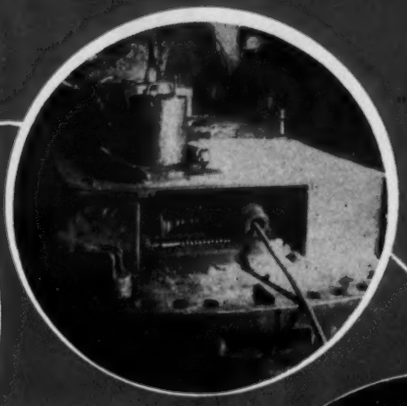
MANSFIELD, OHIO

Canadian Ohio Brass Company, Limited, Niagara Falls Ontario

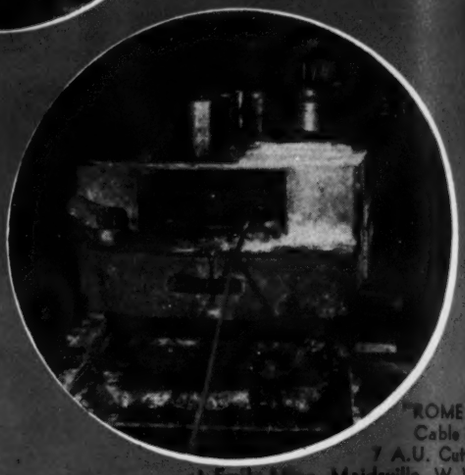
Electrical men KNOW...



"ROME 60" Trailing Cable on Jeffrey 6-Ton Gathering Locomotive



"ROME 60" Trailing Cable in Emily Mine of Monongahela R.&P.C. Corp. Maidsville, W. Va.



"ROME 60" Cable on 7 A.U. Cutter at Emily Mine, Maidsville, W. Va.

..that THIS is TOUGH service...

Some idea of the rigors of Coal Mine service on "Trailing Cable" is suggested by these pictures. Rubbing against rock, coal pillars and timbers—dragged over track and ties, in sulphur-laden water—these "ROME 60" Cables are treated ROUGH.

What does this mean to an electric power company executive?

Simply this—that the same cautious care in manufacturing that makes "ROME 60" cables stand up in service—is applied to the manufacture of ALL ROME CABLE Products.

ROME Cable Products

- Hot Rolled Copper Rods
- Bare & Tinned Strand
- URC Weatherproof Wire
- Bare & Tinned Copper Wire
- Rubber Insulated Wires and Cords
- Lead Covered Cables
- Cotton, Paper and Asbestos Magnet Wire
- "Rome 60" Multiconductor Power Cables
- Network, Service Entrance, Control Cables

ROME-60

ROME CABLE CORPORATION, ROME, N. Y.

100H UNIVERSAL MATTHEWS FUSE LINKS

COVERED BY PATENTS 1,797,850, 2,067,577 AND PATENTS PENDING

BEST FOR CASCADING

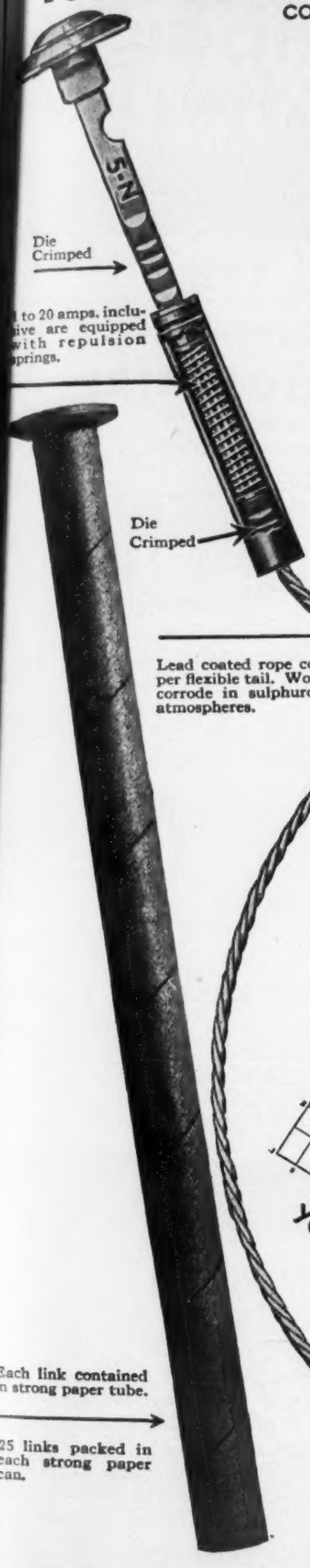
One user of 100-H Links makes it a practice before each lightning season to re-fuse all important cutouts. They claim that this gets rid of all overstressed links and prevents a lot of unnecessary outages and more than justifies its cost. A good way for you to find out that 100-H Matthews Fuse Links are better is to re-fuse some of your more important circuits now and watch the results through the next lightning season.

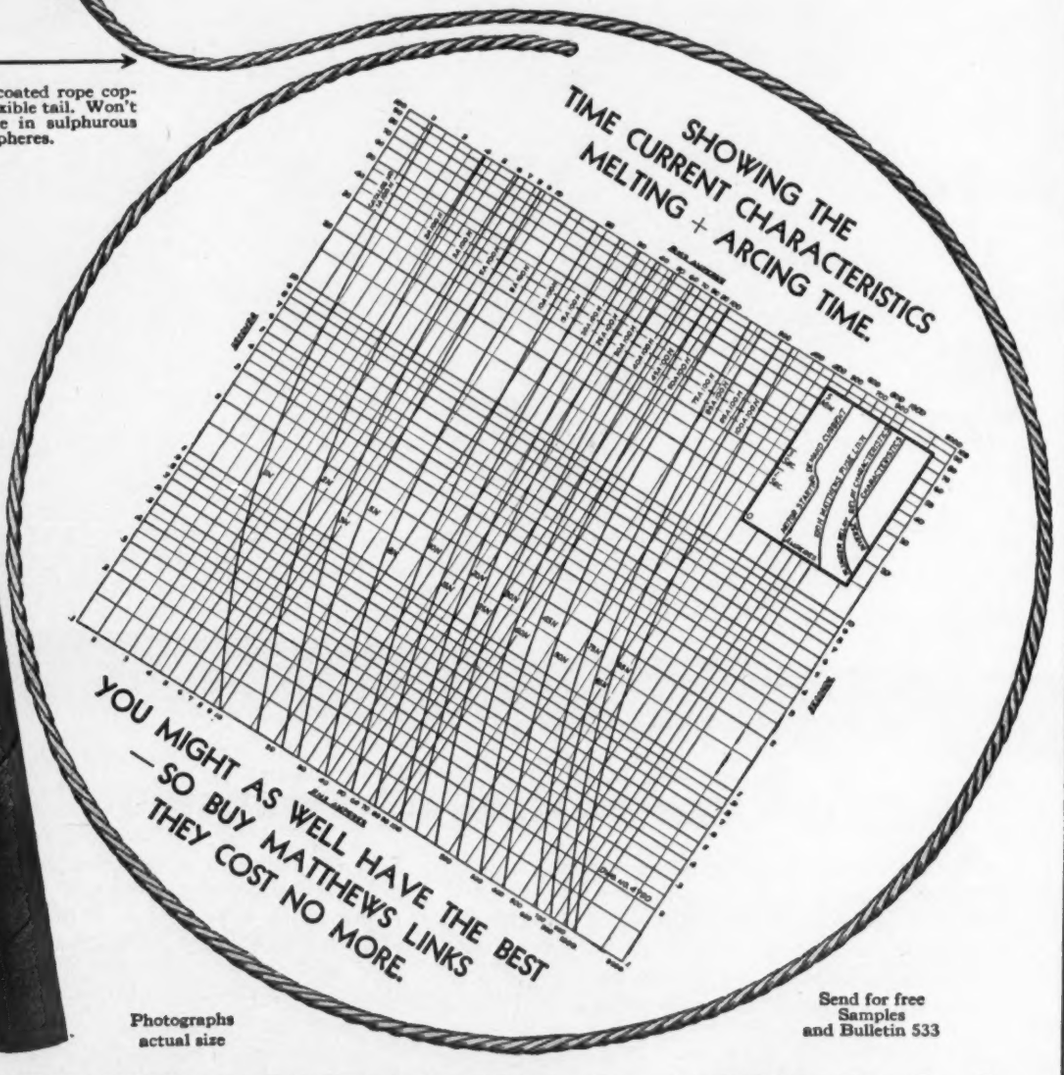
No solder used in them. Fusing elements are of hard drawn copper. They are mechanically stronger.

Their accuracy is guaranteed to be within 10% + or —.

In addition to the 17 sizes shown on the curves below they are made in ½, 125, 150, 175 and 200 ampere ratings.

Photographs actual size. 100-H shown. 50-H same excepting that it is 13 inches overall instead of 26 inches.


5-N
Die Crimped
1 to 20 amps. inclusive are equipped with repulsion springs.
Die Crimped
Lead coated rope copper flexible tail. Won't corrode in sulphurous atmospheres.
Each link contained in strong paper tube.
25 links packed in each strong paper can.


SHOWING THE TIME CURRENT CHARACTERISTICS MELTING + ARCING TIME.
YOU MIGHT AS WELL HAVE THE BEST —SO BUY MATTHEWS LINKS THEY COST NO MORE.

Photographs actual size

Send for free Samples and Bulletin 533

W. N. MATTHEWS CORPORATION, ST. LOUIS, U. S. A.

New Nation-wide Campaign

. . . OFFERS VALUABLE WARTIME HELP

How soup stock in your

FRIGIDAIRE

helps you build many grand meals

Your grocer has less soup, and fewer varieties, because of the wartime needs of our armed forces. But your family can still enjoy wholesome, delicious soup often. For it is easy to make.

Get a head start on several meals by preparing a soup stock. It will add body and flavor to soup and many casserole dishes. Keep a supply in your refrigerator. Save the meat and vegetables from which you prepared the stock and use them in hash, croquettes, soup.

Try this simple Soup Stock recipe*

Here's what you need to make 1½ quarts of soup stock—enough for 12 servings when diluted with an equal quantity of water or vegetable liquors.

2 lbs. meat and bones (uncooked shin of beef or leftover roast and bones)	3 peppercorns 1½ bay leaves 6 cloves ½ cup diced carrot
2 tbsp. fat or salad oil	½ cup diced turnip
2 quarts water	½ cup diced onion
1 tablespoon salt	½ cup diced celery

It's easy to prepare

Cut meat in 1" cubes. Brown ½ meat in fat or salad oil. Combine with remaining meat and bones, water, salt, peppercorns, bay leaves and cloves. Gradually heat to boiling point; remove scum as it rises. Cover; simmer for 3 hours if uncooked meat is used—but only 1½ hours if leftover meat is used. Add carrot, turnip, onion and celery 1 hour before end of cooking time. Strain and cool. (Makes 6 cups of stock; if not, add water to make 6 cups.)

It's easy to keep

Soup stock may be kept for several days. Cool stock quickly by setting pan in ice water. Pour into jars. Cover lightly with waxed paper and place in refrigerator. Store just below freezer; do not freeze. Before using, remove layer of fat. Save fat for home use or for fat salvage.

It's easy to use in dishes like these

Delicious Tomato Soup

2 tbsp. diced onion	2 tablespoons flour
2 tbsp. diced celery	1 cup Soup Stock*
1 bay leaf	1 cup water or leftover vegetable liquors
⅛ teaspoon thyme	Salt
2½ cups cooked or canned tomatoes	Pepper

Combine onion, celery, bay leaf, thyme and tomatoes. Cover; simmer 10 minutes. Strain. Blend flour to smooth paste with ¼ cup stock; add remaining stock, water or vegetable liquors and tomato mixture. Cook, stirring constantly, until thickened. Salt and pepper. Serves 4-6.

Treat your refrigerator right —use it properly

Defrost before frost builds up to ¼ inch (about lead pencil thickness). Cool foods before placing in refrigerator.

After freezing desserts or other foods, turn temperature control back about half way 'til used. After serving, return control to normal.

Avoid frequent and lengthy openings. Get everything needed at one time.

Always use the handle or opener to open and close the door.

To avoid permanent stain, immediately wash off spill-overs on inside or outside of your refrigerator.

Rich Bean Soup

¼ cup chopped celery or celery leaves	1½ cups water or leftover vegetable liquors
1½ cups cooked dried peas, lima or kidney beans	1 cup cooked or canned tomatoes
1½ cups Soup Stock*	Salt Paprika

Combine celery or celery leaves with beans, stock and water or vegetable liquors. Cover; simmer 20 minutes. Add tomatoes; season with salt and paprika. Cover; simmer 5 minutes. Serves 4-6. (Leftover baked beans may be used in place of cooked dried beans.)

15 Minute Vegetable Soup

1½ cups leftover cooked diced vegetables	2 tablespoons diced onion or chives
1½ cups Soup Stock*	1 cup cooked tomatoes
1½ cups water or vegetable liquors	Salt Paprika

Combine vegetables with stock. Add water or vegetable liquors, onion or chives. Cover; simmer for ten minutes. Add tomatoes; season. Cover; heat. Serves 4-6.

Any combination of leftover cooked vegetables may be used: green beans, cabbage, carrots, turnips, peas and celery. The greater the variety, the more delicious the soup!

If you use uncooked vegetables, simmer in stock 1 hour. Add tomatoes and seasoning. Heat.

Glorified Baked Hash

2 cups diced cooked potatoes	¼ teaspoon pepper
2 cups diced cooked meat (soup meat, beef, lamb, pork, veal or chicken)	1 teaspoon Worcestershire sauce
2 tbsp. grated onion	2 tablespoons chopped parsley
1 teaspoon salt	½ cup Soup Stock* ½ cup water or leftover vegetable liquors

Combine potato, meat, onion, salt, pepper, Worcestershire sauce and parsley. Add stock and water or vegetable liquors; mix well. Pour into greased casserole. Bake in moderate oven (350 F.) 1 hour. Serves 4-6.

Buy War Bonds for Victory

See free offer on opposite page

Frigidaire's new booklet, WARTIME SUGGESTIONS, is packed with information like that on this page. Get your free copy from any Frigidaire dealer. Or mail the coupon on the opposite page today.

Next month look for:
"How to Keep Meat"

For Excellence on War Production

FRIGIDAIRE Division of **GENERAL MOTORS**

Pioneering Builders of Home Appliances, Commercial Refrigeration, Air Conditioners

you're tops, I guess you know that. Hewell, he says you make the best coffee in the world. I wish you'd give me the recipe."

And Lou had known she'd meant the recipe for Jody's happiness and comfort.

Natural for a boy who loved his mother to choose a girl something like her. Jody was level headed; he'd picked someone who would make a home like the one in which he'd been happy. It was like the old song—what was it?—"I want a girl just like the girl who married dear old Dad."

That was why, as Jody and Gloria took the vows that made them man and wife, Lou Brandon had felt so richly contented. Of course, it was a little hard to hand over a son and all the things son'd worried about for years; yet it wasn't until Jody married that his mother knew how much he loved her. Her son had been more her son after he got him a wife.

Francis's marriage had been very different.

The moment Fran fell in love, she changed. She withheld herself even from her mother, as though the touch of practical fingers might smudge the brightness of this thing that had happened to her. Lou felt old and heavy-handed and confused before her daughter's bright assurance.

Nor did Lou really know Schuyler Ten Eyck. A lean young man with a busy, distinguished face, a slightly fortunate smile, and manners of peculiar elegance and reserve. A triumphant match for Francis, and the girl was full of pride in her jewel luck at having and being loved by a man who was and had everything she most desired.

Once or twice Lou cocked an eye of speculation upon this dazzling suitor. "He'll expect an awful lot, demand so much," she thought. "Just he'll never ask for it, never say right out what it is. Zeek's a difficult kind to live with." She would have liked to warn Francis; but Francis resented the faintest hint that all was not perfection, the slightest suggestion that she didn't know and understand Schuyler better than anyone in the world.

THE night before they were to leave for Boston, where Francis was to be married in the church that had seen generations of Ten Eycks christened and married and buried, Louise was exhausted from the weeks of preparation and the last day's nervous tension. After she finally had dropped off to sleep, the doorbell rang.

She went to the door, and Sky Ten Eyck was standing on the steps. Though his hat was pulled low, she saw instantly that his face was green-white.

He said, "Is Francis asleep?"

Lou steadied herself. Her friends always said here wasn't anyone to be in an emergency than Lou. Now she looked strong and steady and alert. Without answering, she turned and went softly upstairs.

Fran's room was dainty, green and white as a bowl of lilies. Francis was asleep on her tummy, like a child, her profile clear against the pillow. Just as she had looked on many nights when Lou and Charlie had peeped in on their way to bed, on nights, too, when Lou had knelt beside her bed in loneliness. Fran never woke then, and now the dark lashes lay quiet upon the young cheeks.

This new free booklet from

FRIGIDAIRE

helps you solve many wartime food problems

36 pages of simple, practical suggestions—specially prepared to give wartime help to those who bought more than 7 million Frigidaires—now offered to every refrigerator user! Call or send for your free copy of WARTIME SUGGESTIONS today.

You face new problems

The war has played havoc with meal-planning. Almost daily you are confronted with new food-buying and food-keeping problems.

Our major responsibility is to turn out weapons and war materials for our armed forces. Yet knowing how important refrigeration is, we are anxious to help solve some of your wartime refrigeration problems.

Necessary wartime measures may have changed your pattern of living. Particularly your shopping and eating habits. For some foods are rationed. Others are not always easy to get. Besides, store deliveries have been curtailed. Shopping trips are fewer.

Even so, your refrigerator can help make meal-planning easier—if it is used properly.

Frigidaire tells you how

Frigidaire's new, timely booklet, WARTIME SUGGESTIONS, is filled with useful, helpful ideas. It tells you how to make your refrigerator seem larger, how to keep ready-cooked foods on hand, now that canned foods are rationed. Gives meat-keeping facts you need today. Tells how to use left-overs. Lists easy ways to give your refrigerator the best of care. Answers dozens of questions every housewife is asking.

We want you to have a copy. It represents the combined thinking of Frigidaire home economists, engineers, and service experts.

More help to come

Get your free copy of WARTIME SUGGESTIONS now. Then watch for Frigidaire messages that will help you solve new food-keeping problems as they arise.

Do you know these things?

Do you know how to defrost and completely clean your refrigerator in just fifteen minutes? WARTIME SUGGESTIONS tells you.

Do you know all the facts about keeping fresh meat safely? Which meats should be frozen, if kept more than twenty-four hours? WARTIME SUGGESTIONS tells you.

Do you know what can safely be kept outside of your refrigerator; what must go in? WARTIME SUGGESTIONS tells you.

Get WARTIME SUGGESTIONS booklet from your Frigidaire Dealer or mail coupon below

Look for the Frigidaire sign on your dealer's store, or find name and address in the classified pages of your telephone directory under this heading:

FRIGIDAIRE REFRIGERATORS
Today it's especially important to take good care of your Frigidaire Refrigerator and thus enjoy fully the protection and economy it was built to provide.
PRODUCTS OF GENERAL MOTORS
"FOR SERVICE CALL"

FRIGIDAIRE DIVISION,
General Motors Corporation,
347 Taylor St., Dayton, Ohio

Please send me my free copy of your "WARTIME SUGGESTIONS."

Name.....

Address.....

City.....State.....

New! NATIONAL ADVERTISING

Frigidaire's new advertising will give women timely, helpful and authentic information the way they are used to finding it in their favorite women's magazines.

The above advertisement is typical. Now that canned foods are rationed, more women will prepare soup at home. Frigidaire provides a real service by telling homemakers how to make a simple soup stock, how to keep it, and ways to use it in wholesome, nourishing dishes. It is the kind of advertising that will be widely read and sincerely appreciated by women everywhere.

Each advertisement in the series deals with a timely food or refrigeration subject of special interest to women. Each refers readers to the Frigidaire Dealer for Frigidaire's Free WARTIME SUGGESTIONS booklets. Each tells how to locate the Frigidaire dealer, thus tying him in directly with this National Campaign.

Watch for this Frigidaire Advertising in Ladies' Home Journal, Woman's Home Companion, Good Housekeeping, McCall's, Better Homes and Gardens, American Home, Farm Journal and Farmer's Wife, and True Story!

by FRIGIDAIRE

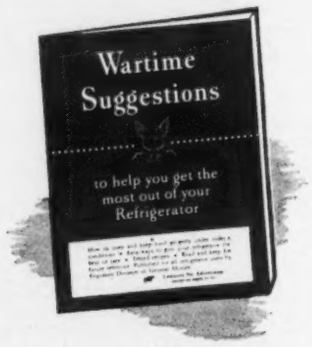
EVERY HOMEMAKER NEEDS TODAY!

Has These 4 Important Objectives:

1. To cooperate with the Government's programs for conserving the nation's food and food-keeping equipment.
2. To render a real and needed service not only to Frigidaire users, but also to the users of all other refrigerators.
3. To help keep the name Frigidaire before the public in a way that will be favorably remembered.
4. To help Frigidaire Dealers maintain their identification with Frigidaire and to build good will for themselves.

Like many other manufacturers, our major responsibility is to build war materials for our armed forces. Yet recognizing the importance of refrigeration to the food and health of America, we are embarking upon a new nation-wide campaign to help homemakers solve their new wartime problems. The benefits of our unequalled refrigeration experience will be passed on to the users of the more than 7 million Frigidaires that have been sold—and to all other refrigerator users.

We firmly believe that this campaign will contribute to the war effort on the home front and bring real and substantial benefits to every member of the Frigidaire organization.



New! WARTIME SUGGESTIONS Booklet

To help Frigidaire Dealers benefit fully from this new Campaign, they will receive, without charge, Frigidaire's popular WARTIME SUGGESTIONS booklets for free distribution in their communities.

This booklet, originally introduced nearly a year ago, has now been revised and enlarged to 36 pages. It's literally packed with practical and useful ideas like those shown on the opposite page. It tells how to keep meat, what to keep in a refrigerator, what to leave out, how to defrost in 15 minutes. It gives tested wartime recipes and dozens of other helpful tips on how to make a refrigerator serve better and last longer.

Backed by 25 years' experience in the food-keeping field, the WARTIME SUGGESTIONS booklet represents the combined thinking of Frigidaire Home Economists, Engineers and Service Specialists. It was prepared with the assistance of leading women's magazine editors and reviewed by other eminent food authorities.

New! DISPLAY MATERIAL FOR DEALERS

Each Frigidaire dealer also will receive without charge new display material to tie in his store with Frigidaire's nation-wide program—to help distribute WARTIME SUGGESTIONS booklets to store visitors and to merchandise the magazine advertising messages to his customers.

FRIGIDAIRE Division of GENERAL MOTORS CORPORATION • Dayton, Ohio

● These are only part of our plans to help dealers benefit from this new program. Complete details are now being given to the Frigidaire Dealer Organization

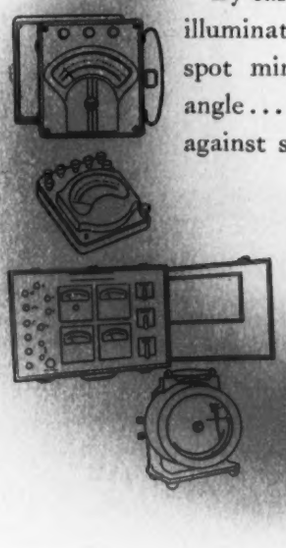
casting "shadows" of Victories to come...

This shadow foretells a successful bombing raid—a victorious sea battle—or an increase in war production. It is a 500 to 1 enlargement of one of the tiny pivot points on which instruments depend for their accuracy.

By casting this enlarged shadow on an illuminated template, inspectors quickly spot minute variations in radius and angle... accurately check every pivot against strict size and fit requirements.

In today's mechanized war, instrument accuracy is of paramount importance... in tanks, ships, planes...

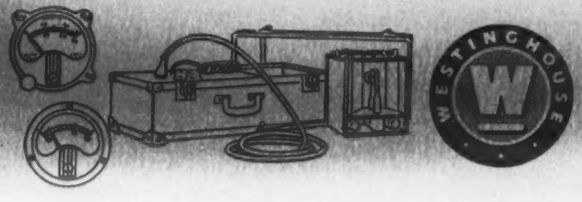
Consequently, Westinghouse Instruments are now being manufactured with still greater accuracy and wear resistance ...guaranteeing that when peace returns, you can look to us for instruments far better than the finest that have yet been built. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pennsylvania, Dept. 7-N. J-40336

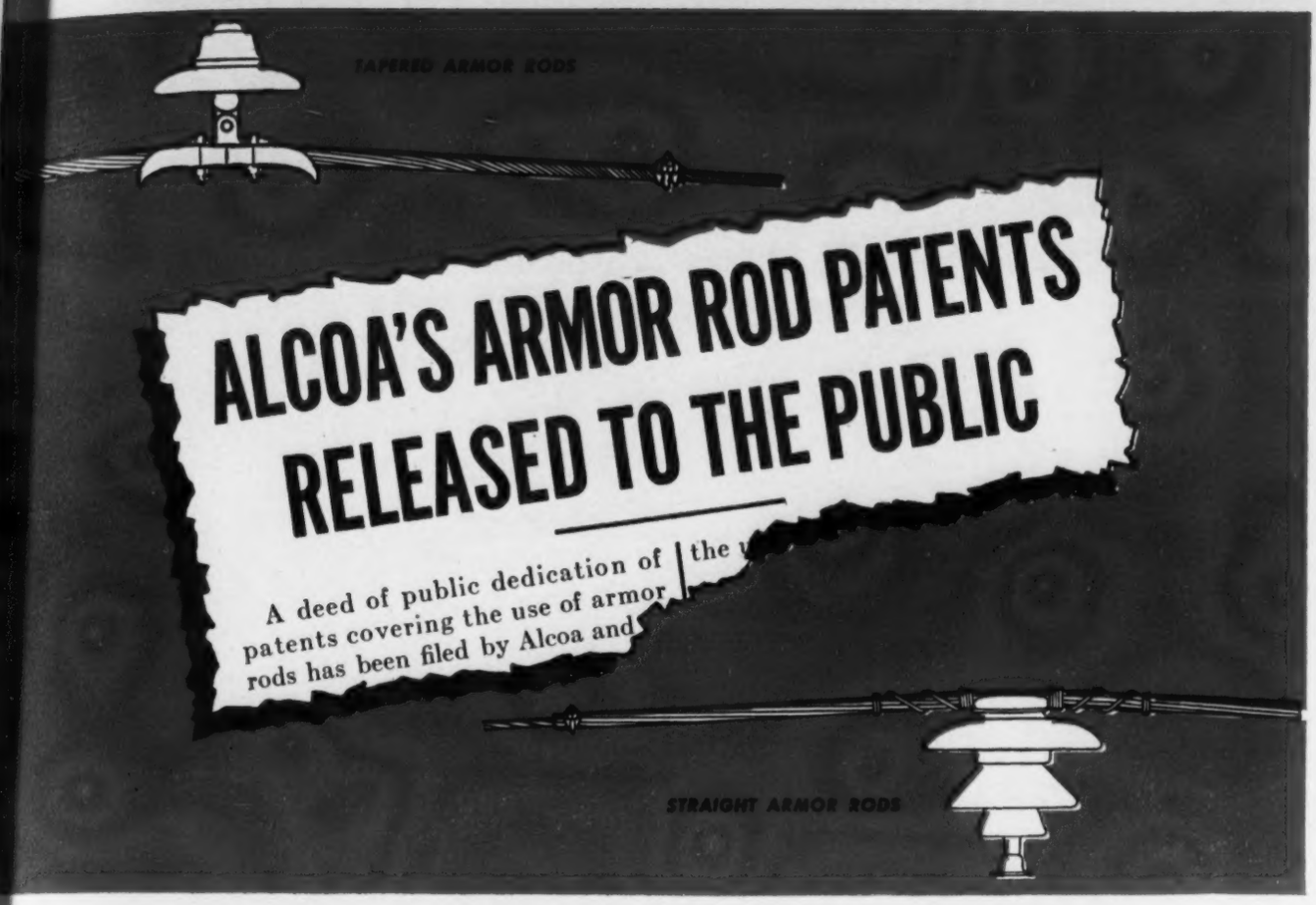


THIS IS A WAR OF INSTRUMENTS

Westinghouse INSTRUMENTS

PLANTS IN 25 CITIES... OFFICES EVERYWHERE



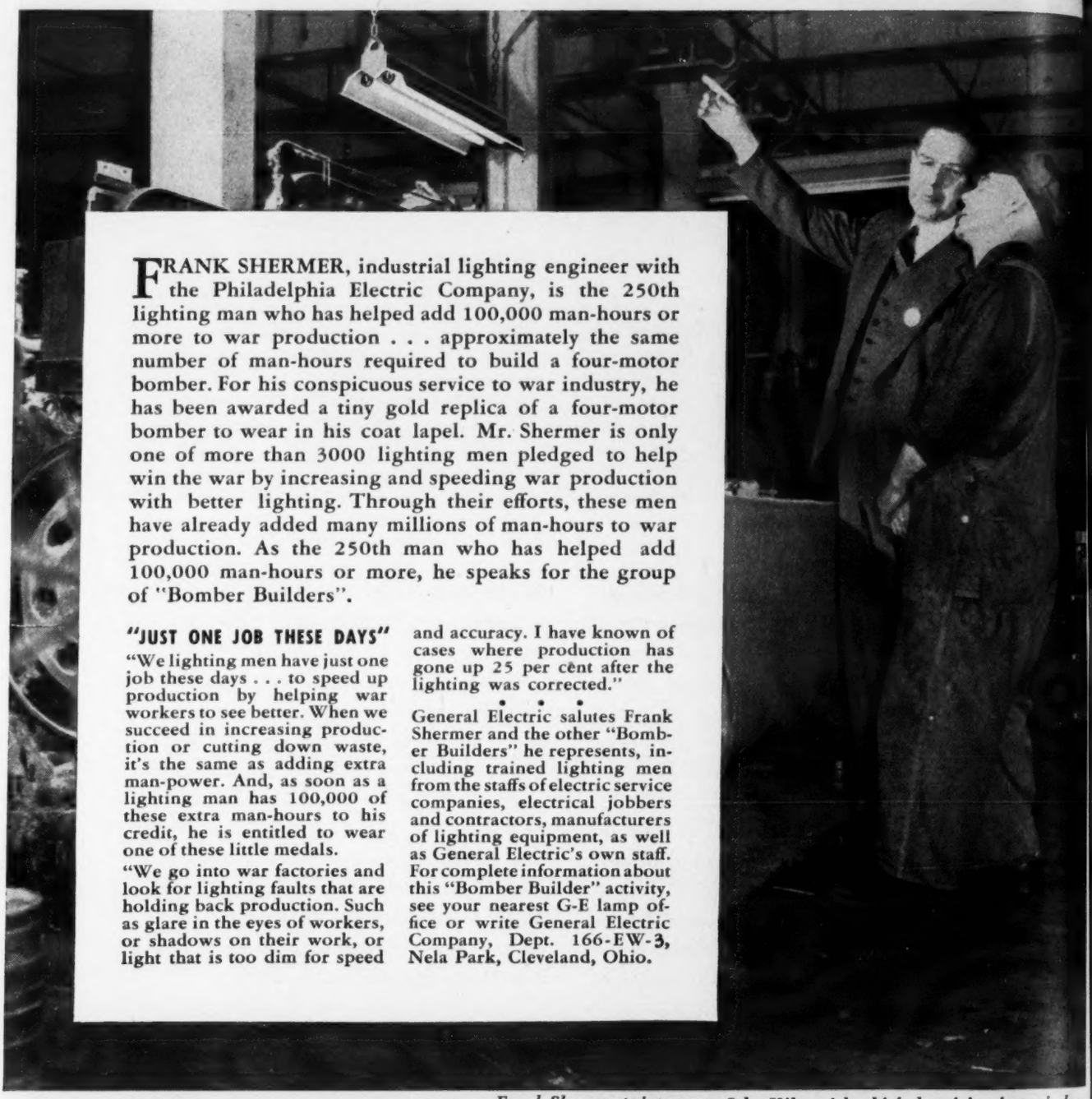

TAPERED ARMOR RODS
ALCOA'S ARMOR ROD PATENTS RELEASED TO THE PUBLIC
A deed of public dedication of patents covering the use of armor rods has been filed by Alcoa and
STRAIGHT ARMOR RODS

Desiring to serve the industry in the best possible way, we have released to the public patents covering the use of armor rods. This makes available to everyone, without the need for licensing procedure, a technique which, though originally developed for use with A.C.S.R., has since been employed on all kinds of conductors.

Armor rods resemble an extra layer of heavy strands covering the cable for a short distance each side of the insulators. Invented as protection against fatigue caused by resonant vibration, they increase the resisting moment of the cable at points of support. This distributes the stress due to bending, strengthens the cable at these critical points, and reduces its amplitude of vibration. The rods also protect the cable against burning by flashovers.

Most important right now, damaged conductors can be repaired with armor rods; thus often eliminating the need for new conductors. Where strands in a cable have been broken at an insulator, or burned by insulator breakdowns or flashovers, addition of armor rods usually makes the conductor "good as new." Alcoa engineers will gladly tell you how to employ armor rods on all kinds of power conductors. ALUMINUM COMPANY OF AMERICA, 2138 Gulf Building, Pittsburgh, Pennsylvania.

PHILADELPHIA ENGINEER IS 250TH LIGHTING MAN TO WIN BOMBER AWARD



FRANK SHERMER, industrial lighting engineer with the Philadelphia Electric Company, is the 250th lighting man who has helped add 100,000 man-hours or more to war production . . . approximately the same number of man-hours required to build a four-motor bomber. For his conspicuous service to war industry, he has been awarded a tiny gold replica of a four-motor bomber to wear in his coat lapel. Mr. Shermer is only one of more than 3000 lighting men pledged to help win the war by increasing and speeding war production with better lighting. Through their efforts, these men have already added many millions of man-hours to war production. As the 250th man who has helped add 100,000 man-hours or more, he speaks for the group of "Bomber Builders".

"JUST ONE JOB THESE DAYS"

"We lighting men have just one job these days . . . to speed up production by helping war workers to see better. When we succeed in increasing production or cutting down waste, it's the same as adding extra man-power. And, as soon as a lighting man has 100,000 of these extra man-hours to his credit, he is entitled to wear one of these little medals.

"We go into war factories and look for lighting faults that are holding back production. Such as glare in the eyes of workers, or shadows on their work, or light that is too dim for speed and accuracy. I have known of cases where production has gone up 25 per cent after the lighting was corrected."

• • •

General Electric salutes Frank Shermer and the other "Bomber Builders" he represents, including trained lighting men from the staffs of electric service companies, electrical jobbers and contractors, manufacturers of lighting equipment, as well as General Electric's own staff. For complete information about this "Bomber Builder" activity, see your nearest G-E lamp office or write General Electric Company, Dept. 166-EW-3, Nela Park, Cleveland, Ohio.

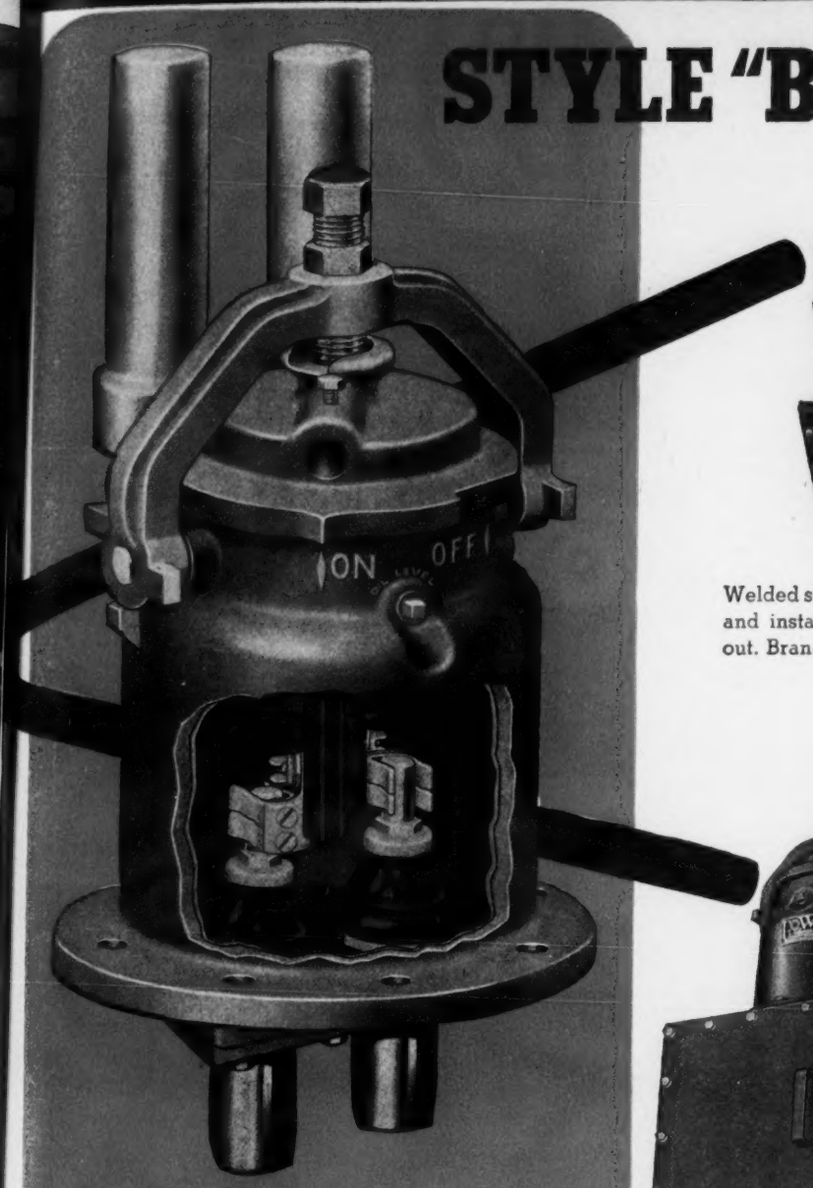
Frank Shermer points out to John Kilpatrick, chief electrician in an industrial war plant, how lighting has broken a former production bottleneck.

G-E MAZDA LAMPS

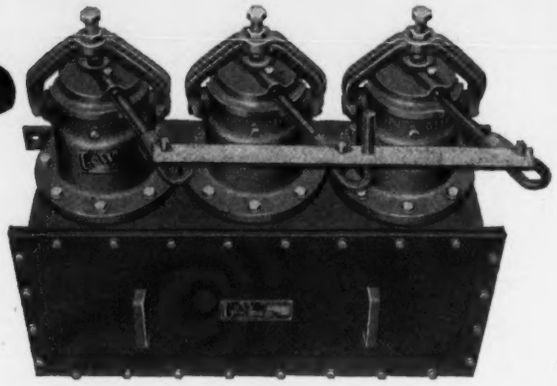
GENERAL ELECTRIC

As this magazine goes to press, we are able to report that 318 of these men have now been awarded Gold Bomber pins.

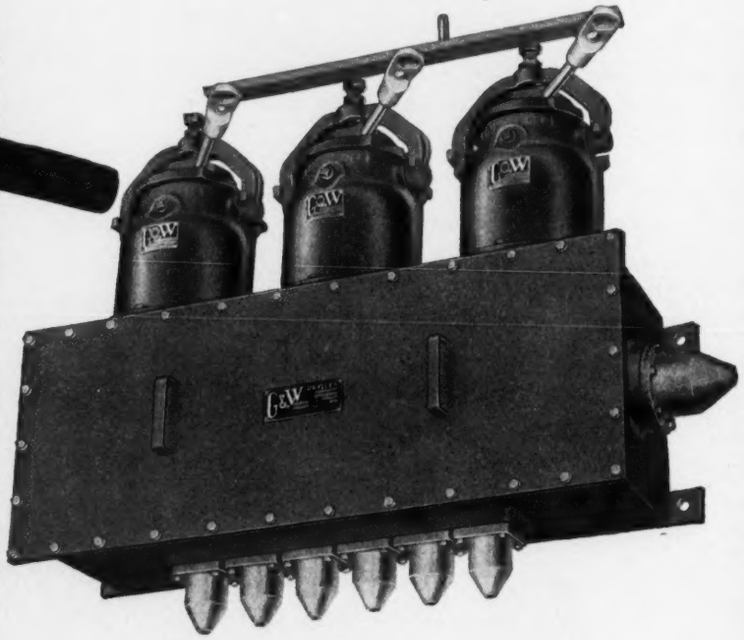
G & W TYPE "FC" OIL FUSE CUTOUTS



STYLE "B" WITH GASKETED FLANGE FOR MOUNTING ON BOXES



Welded steel boxes, factory assembled with oil fuse cutouts, save space and installation labor. Main circuit cables can be brought in and out. Branch circuit or transformer taps can be made within the box.



The years of trouble-free service has created a wide acceptance of G & W Type "FC" Oil Fuse Cutouts. The modern design provides interchangeability of parts for various installation conditions. The interlocking cover and cover clamp insures safety in fuse replacement. The simple and inexpensive fuse link universally fits all Type "FC" cutouts.

½ cycle interruption of short circuits protects equipment.

Beryllium copper springs make ideal full load break switching contacts.

Send for Bulletin No. 425

G & W ELECTRIC SPECIALTY CO.

7780 DANTE AVENUE CHICAGO, ILL., U. S. A.

Also made in Canada by Powerlite Devices, Ltd., Toronto

GANG OPERATED

FOR FUSING AND SWITCHING PRIMARY CIRCUITS SUBWAY – OVERHEAD – VAULTS

At the front

in the war on wear–

Gulf Diesel Oils have greater stability and stamina . . . provide better lubrication under today's peak-load and over-load conditions.

Actual photo of a Gulf Lubrication Service Engineer consulting with power plant engineer on Diesel engine lubrication. After 25,000 hours with Gulf Diesel lubricating oil in service in this Worthington Diesel, cylinder wear totals only .005 inches.

THE peak-load and over-load operating conditions of today have greatly multiplied the problem of avoiding excessive wear of Diesel cylinders, pistons, and bearings. Now, more than ever, it pays to use lubricating oils that provide an extra margin of protection to these vital parts.

You insure this kind of protection when you put Gulf Diesel oils in service to lubricate your units. For built into these quality oils is greater stability and stamina—they stand up and provide a tough film of highest lubricating value that keeps friction at a minimum even under severe operating conditions—conditions which often put units out of service for overhauls and repairs.

Gulf Diesel oils have made outstanding performance records in many plants. After 25,000 hours with Gulf Diesel oil in service in a paper mill unit, for example, cylinder wear totals only .005 inches.

For higher operating economy and less "down-time" in your plant, take this step today: Call in a Gulf Lubrication Service Engineer and ask him to recommend the proper type and grade of Gulf Diesel lubricating oil to fit your particular requirements. His thorough training and broad practical experience with all types of Diesel engines is your assurance of sound and helpful recommendations.

Gulf Oil Corporation · Gulf Refining Company

Gulf Building, Pittsburgh, Pa.

FOR VICTORY
BUY UNITED
STATES WAR
SAVINGS BONDS
AND STAMPS

GULF INDUSTRIAL LUBRICATION

Dependable

DUNCO MERCURY RELAYS

NON-WELDING, DIRT-FREE CONTACTS

Dunco Mercury-Contact Relays have established enviable standards of performance on applications where high inrush loads, such as on lamps and motors, must be controlled, or for use where dust and fumes might foul ordinary contacts.

Rugged, heat-proof glass tubes keep the mercury in perfect condition, guarding it against fouling from contact with metal parts. On the Dunco Laminated Clapper Type Relays (Series 91), these tubes tilt over a wide angle, assuring positive contact without the need for any unusual mounting precautions. Dunco Mercury Swing Types (Series 22) require level mountings. These units have the advantage of making noiseless contact, and being lower in price.

Other Dunco Relay-Timer Types

30 ampere—Sensitive—Instrument Controlled—Low Voltage, Heavy Current, D.C.—Mechanical Latch-in (Electrical Reset)—Telephone Auxiliary—Lamp Controlling—Polarized—Overload—Timing—Industrial Control and Power Transfer—Sequence, Ratchet Type—Motor Reversing, and many others.

Write for the New Dunco Catalog and Relay Data Book.

STRUTHERS DUNN, Inc.

1321 ARCH STREET **PHILADELPHIA, PA.**

LET DUNCO DISTRICT ENGINEERS IN 28 STRATEGICALLY LOCATED CENTERS HELP SOLVE YOUR RELAY PROBLEMS

The dawn of Peace

WILL REVEAL NEW TRANSFORMER HORIZONS

War-born improvements in design and construction will bring you even better AMERTRAN Products . . .

AmerTran is in the thick of the fight now, on war production . . . and under the stress we are developing improvements that we cannot now reveal. But some day the complete story will be told . . . and the better transformers we are shipping to those with priorities today, for wartime production, will be available for all to use. Improved designs and manufacturing methods, born under the spur of necessity—will bring you even better AmerTran products than those you know now . . . will still further confirm the leadership that AmerTran has gained and held during the past 42 years in the electrical field, in industrial and utility applications. While the war lasts—plan ahead! Plan for the peace boom with AmerTran improved transformers.

AmerTran power transformers available for all requirements in sizes to 10,000 KVA, 132 KV.

AmerTran distribution transformers of either oil- or noninflammable-liquid-immersed type available in sizes to 500 KVA., 72 KV.

Amer-Tran air-cooled transformers for either indoor or outdoor service are available for all industrial requirements — sizes to 150 KVA.

AMERICAN TRANSFORMER COMPANY, 178 Emmet St., Newark, N.J.

Manufactured Since 1901 at Newark, N. J.

AMERTRAN

AmerTran transformers are manufactured to meet your exact electrical and mechanical requirements for all applications, and in sizes up to 10,000 Kva.

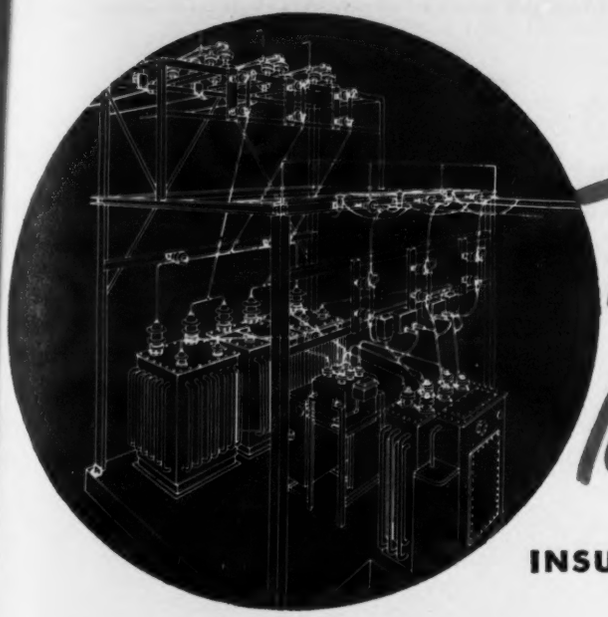
Sure Ground
TYPE GX
TYPE GB
TYPE GP
TYPE GR
TYPE GA
Headquarters for Connectors
BURNDY
GROUND CONNECTORS
Burndy Ground Connectors afford reliable, *low resistance* ground connections, *with high resistance* to underground corrosion. All parts are designed for ample strength, and each Burndy Ground Connector is *engineered* for its own specific job.
And that's true of all Burndy Connectors. Take the Burndy Servit, for example. This compact service connector gives some 50% greater pressure on the conductors—thanks to a design which wastes less torque in overcoming thread friction. Each size accommodates a large range of conductors and can be used over and over again. Bulletin on request.
BURNDY SERVIT
TYPE KS
BURNDY ENGINEERING CO., INC. • 107 Eastern Boulevard, New York City

HERE'S YOUR FILE OF CRESCENT "TOOL NOTES"

Helpful tool information covering the use, maintenance, repair and conservation of Crescent Wrenches, Pliers, Snips, Hacksaws, Screwdrivers, Cold Chisels, Punches and Nail Pullers. The Set contains 8 sheets, 8½ x 11", punched for standard 3-ring binder and stapled between serviceable covers.

Write for a copy today. For classroom and bulletin board use, sets can be furnished unstapled and without covers.

TOOL NOTES
Maintenance and Repair Suggestions to Prolong Tool Life
No. 1 HOW TO KEEP CRESCENT WRENCHES IN GOOD WORKING ORDER
● Regardless of war or shortages, a good mechanic always keeps his tools in excellent shape. Today, however, difficulty of replacement is perhaps the strongest argument for tool conservation. This is the first in a series of informative advertisements intended to help you make your "Crescent" and "Crestoloy" Tools last longer. Look for "TOOL NOTES" regularly.
With adjustable wrenches, as with most tools, abuse and neglect are the commonest cause of failure. Keep your wrenches clean — and oiled. Dirt or rust accumulations on the knurl or other moving part will make adjustment difficult. Don't use your wrench as a hammer — and don't hammer on the handle to start or "set" a nut. Never "overload" any tool. The handle length of your wrench is carefully computed to provide safe leverage at maximum opening. If you extend the handle length with a piece of pipe or tubing you are taking chances with most wrenches. The 15", 18" and 24" sizes of "Crestoloy" Wrenches (with tapered handles) have sufficient strength, however, to permit this practice.
USE YOUR WRENCH CORRECTLY
Generally speaking, the CRESCENT Wrench should be turned in the direction indicated by the arrow in the drawing. However, when nuts are being tightened or loosened in close quarters, it is permissable to use the wrench either way. That is why the jaws are set at an angle to the handle. Main point to remember is to have the jaws TIGHT upon the nut being turned. If this precaution is observed, the wrench will not slip and a good, hard pull can be exerted without fear of bruised knuckles or skinned fingers.
Strain comes at these points
Turn wrench in this direction
REPAIR PARTS AVAILABLE
Jaw
Knurl
Spring
Pin
Broken wrenches can be repaired with these Crescent Parts, sold by hardware dealers. Ask for part by name, stating the size of your wrench and whether "Crescent" or "Crestoloy" as marked on handle. Be sure to replace knurl same end to as removed. or teeth will not line up.
CRESCENT TOOLS
Give Wings to Work
CRESCENT TOOL COMPANY, JAMESTOWN, N. Y.
CRESCENT TOOL CO., JAMESTOWN, N. Y.



To reduce outages.. localize breakdowns

SPECIFY WESTINGHOUSE APPARATUS

INSULATORS FOR THE ENTIRE SUBSTATION

FROM 7½KV TO 287KV WESTINGHOUSE APPARATUS INSULATORS MEET EEI AND NEMA BASIC INSULATION LEVEL STANDARDS

Today's substation installations have an important job to do. There's no time for service outages because of unexpected insulator failure.

That's why we say, "Specify Westinghouse B.I.L. Standard Apparatus Insulators."

- The line is *complete,* ranging all the way from 7½ kv to 287 kv capacity.
- Each insulator conforms to EEI and NEMA "Basic Insulation Level" standards.
- Each insulator can be depended upon to provide a predetermined basic insulation level.

With these advantages, you can co-ordinate your entire substation at the correct insulation level. You can design your system to reduce outages, and—if electrical breakdown from lightning occurs—localize it at a point where the least damage will result to apparatus and service.

Next time you order outdoor apparatus insulators, specify Westinghouse porcelain. Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa. Factories at Derry, Pa., and Emeryville, Calif. J-05137

69 kv Insulator

Withstand Impulse Voltage: 350 kv with 1½ x 40 microsecond positive wave.

Dry Voltage: 175 kv, 60 cycle, 1 minute withstand.

Wet Voltage: 145 kv, 60 cycle, 10 second withstand.

Radio Noise Influence Voltage: 200 microvolts at 44 kv test voltage to ground.

46 kv Insulator

Withstand Impulse Voltage: 230 kv with 1½ x 40 microsecond positive wave.

Dry Voltage: 120 kv, 60 cycle, 1 minute withstand.

Wet Voltage: 100 kv, 60 cycle, 10 second withstand.

Radio Noise Influence Voltage: 200 microvolts at 30 kv test voltage to ground.

PLUS R.I.P. at no extra cost

R.I.P. stands for Radio-Interference-Proof—the simple permanent answer to all problems of insulator-generated radio noise. All Westinghouse Outdoor Switch and Bus Insulators, including the new units, are Radio-Interference-Proof.

7½ kv Insulator

Withstand Impulse Voltage: 95 kv with 1½ x 40 microsecond positive wave.

Dry Voltage: 35 kv, 60 cycle, 1 minute withstand.

Wet Voltage: 30 kv, 60 cycle, 10 second withstand.

Radio Noise Influence Voltage: 50 microvolts at 5 kv test voltage to ground.

Westinghouse PORCELAIN

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

The Red Cross has Problems like your own

—*of Planning*

Your Red Cross operates a vast planning program to enable it to be ready for any disaster or emergency anywhere—whether it comes in the Americas, Europe, Australia, Asia, or Africa.

—*of Organization*

Your Red Cross is responsible for the smooth operation of 3,750 chapters and 6,000 branches, all engaged in the same enterprise of helping all who need help.

—*of Personnel*

Your Red Cross has tripled its staff since Pearl Harbor and has had to enlist the aid of and train over 6,000,000 volunteers in the principles of First Aid, Water Safety, Accident Prevention, Home Nursing, Nutrition, Nurse's Aideing, Mass Feeding, Motor Mechanics, and other subjects allied to our country's war effort.

—*of Production*

Your Red Cross is not only one of the world's foremost purchasers of supplies, but it has the immense distribution job of collecting millions of items from 10,000 different communities in the United States, assembling and storing them, and then shipping them to practically every country in the world. Last year your Red Cross shipped some $60,000,000 worth of food, clothing, and medical supplies to over 20,000,000 homeless people in foreign countries.

—*of Finance*

Your Red Cross, whose war-time and post-war expenses will run well into hundreds of millions, must account to the public for every penny it collects and puts to work. Its accounts are audited annually by the U.S. War Department.

The Red Cross faces the same problems as are in your business. With your support it can successfully meet them.

The Second War Fund is greater than the First, but no greater than the increased needs.

Business men can help with time and with money, as organizations and as individuals.

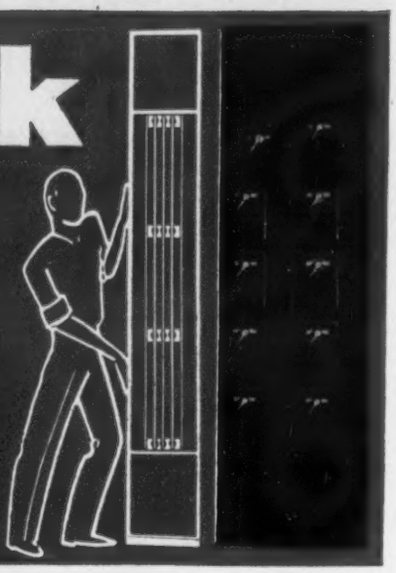
March is the Red Cross month . . . Cooperate with your Red Cross Chapter.

Your Dollars help make possible the

AMERICAN RED CROSS

This space contributed by the Publisher

building-block simplicity..



IN ELECTRICAL CONTROL ASSEMBLY...

Installation of four Motor Control Centers mounted back to back... 98" high, 21" deep, for each pair. CONTROL AT CENTER OR BY PUSH BUTTON AT MACHINE STATION.

CUBICLE PLUG-IN UNITS

Right: Control Center 13½" bus bar trough, with pull boxes top and bottom and Sizes 1, 2 and 3 motor control units. (Switchboard control units are in corresponding sizes).

Trumbull Centralized Electrical Control is assembled to meet your exact load and space requirements almost as easily as you might put together building blocks or file cabinets. We have, in fact, applied the principles of mass production and standardization of interchangeable units to give industry not only the simplest and most flexible, but also the most efficient cubicle switchboard assembly yet devised.

Here's how it works. First, you arrange Trumbull prefabricated bus bar troughs to accommodate the required number of control units in the space available (back to back, flat against walls or any way you wish). Then you install standardized switching and control units in the troughs by stab connections in a matter of minutes. Finally you make your conduit connections in the ample wiring spaces at top and bottom of the troughs and lead your circuit wires to individual units through the convenient vertical raceways built into the troughs to complete the flattest, neatest, most easily get-at-able dead front switchboard or motor control center you have seen. Everything is installable, removable, inspectable FROM THE FRONT. Trough sections or individual units can be changed or added just as quickly and easily ... a necessity in busy plants today; assurance of flexibility for tomorrow's changing needs.

CONTROL CENTER SWITCHBOARDS

Type "A" switch units, Type "AT" circuit breaker units, 30 to 600 amps. or combinations of both may be grouped in any desired assembly to centralize power and light feeder-circuit protection and control. Also, the standardization feature permits the combining of both motor control and switchboard functions in one assembly.

TRUMBULL

CONTROL CENTERS

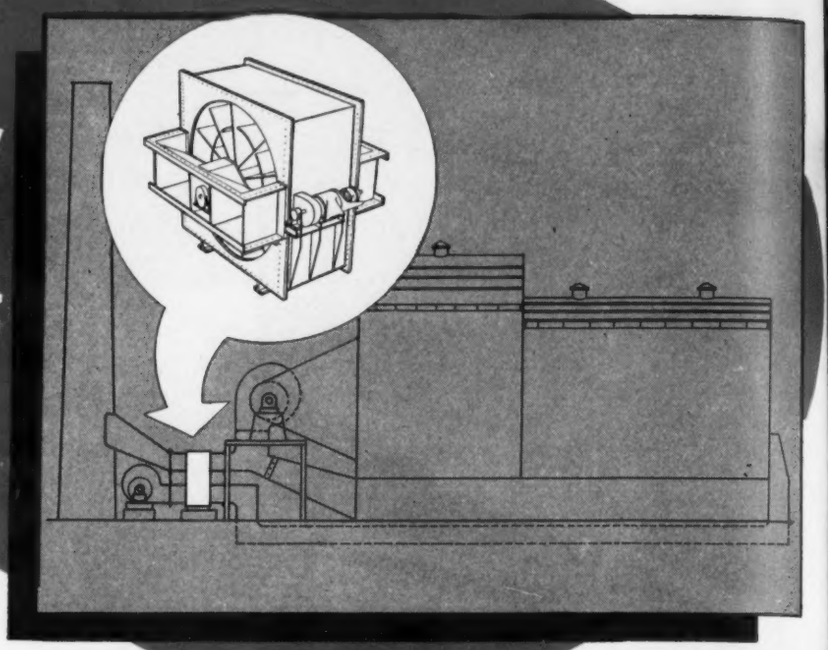
MOTOR CONTROL CENTERS...

The motor Control Centers are space saving assemblies in one cabinet of Trumbull combination magnetic starter with switch or circuit breaker disconnect. Sizes 1, 2, 3 or 4...3 to 100 H.P. Regrouping or expansion at any future time is most easily accomplished. Trumbullaid Bulletin 411 on request.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY • PLAINVILLE, CONN. • A GENERAL ELECTRIC ORGANIZATION

OTHER FACTORIES AT NORWOOD (CINN.) O. — SEATTLE — SAN FRANCISCO — LOS ANGELES

SAVING BTU for "SUPER" Superheat



Ljungstrom Air Preheaters on Separately-fired Superheaters Help Supply *1400°* Steam for Synthetic Rubber Process

To furnish the low-pressure, high-temperature steam required by certain synthetic rubber processes, separate re-heating furnaces supplement the steam generating boilers. Recovery of heat from flue gases thus becomes a doubly important problem. On the typical unit shown here, a Ljungstrom Air Preheater reduces exit gas temperatures from 770° to 390°. The combustion air to the furnace is raised to 585°, thus increasing combustion efficiency as well as saving BTU.

• • •

This is only one of several new applications of this flexible gas-to-air heat-transfer unit, over and above its primary application to high-efficiency boiler plants. In each case, conservation of *fuel* and conservation of *steel* are obtained together, and continuity of operation is fully protected.

Ljungstrom Air Preheaters average one-half to one-third the weight of other types for the same degree of heat recovery. In the Ljungstrom, the heating surface is not a wall surface between the gas and air, but a *regenerative* surface that acts to "soak up" heat in the high temperature side and then, upon rotation, to liberate it in the entering air. This *continuous regenerative counterflow* principle accounts for maximum heat transfer with minimum space and weight.

If you are faced with a heat-recovery problem to which this type of unit is applicable, Ljungstrom engineers will gladly put at your disposal the experience gained on hundreds of successful applications. Just write:

THE

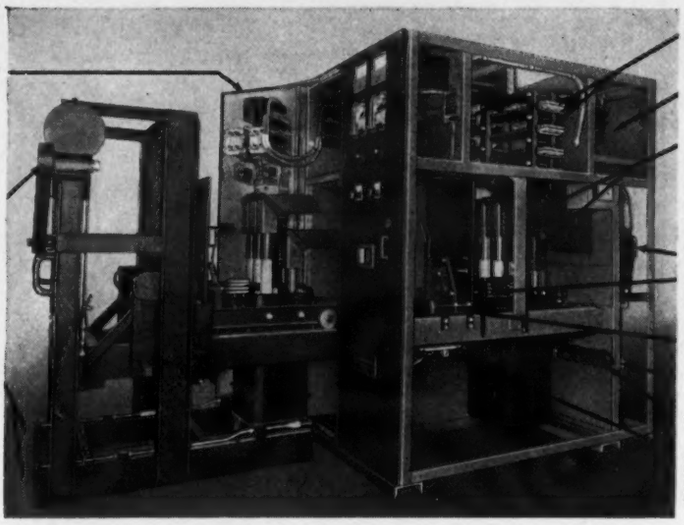
AIR PREHEATER

CORPORATION

Executive Offices: 60 East 42nd Street, New York, N. Y. • Plant: Wellsville, New York

Examine Its Construction

AIR CIRCUIT BREAKERS TYPE HO
OIL CIRCUIT BREAKERS CLASSES 150 TCR-3 & 250 TCR-3
METAL-CLAD SWITCHGEAR
ROLLER-SMITH COMPANY



Metal-Clad Structure with End Plate Removed, to Show Circuit Breaker in Operating Position. Breaker in Adjacent Compartment is Being Removed by Means of the Handling Truck.

ROLLER SMITH

Metal Clad Switchgear

AIR CIRCUIT BREAKERS

Air Circuit Breakers are built in various sized units for protecting AC circuits having a continuous rating up to 6000 amperes at 600 volts, and DC circuits up to 10,000 amperes at 250 volts. They are inherently trip-free and cannot be held closed against abnormal overloads or short circuits. Among other features, the effectiveness of its simply designed arc-quencher has been proved in the R-S test station and in operating service.

These breakers also can be supplied in rigid or drawout type air circuit breaker switchboards. For full details request Catalogs 1230 and 2150.

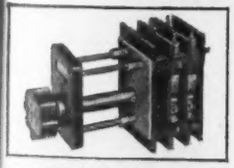
The flexibility needed to meet changing loads in war plants is inherent in factory built...wired...and tested R-S metal clad switchgear. It is necessary only to change the incoming leads and mount in its new location.

Metal-clad switchgear saves man-hours, too. Whenever inspection, adjustment or replacement of parts are necessary, it only takes a few minutes to withdraw and replace the circuit breaker with an entire spare unit. Each removable section includes an oil-circuit-breaker of 100,000, 150,000 or 250,000 KVA interrupting capacity, with primary isolating enclosures; primary, secondary and ground disconnecting devices; mechanical interlocks and racking mechanism.

Safety is afforded the operator. The breaker can be inspected or repaired ONLY by removing it from the stationary unit.

Look over the picture above and you'll recognize other important elements in the design and construction of this equipment. Better yet — write to-day on your Company letterhead for a copy of the R-S Loose Leaf Data Book — a reference book valuable to every central station or industrial power plant executive.

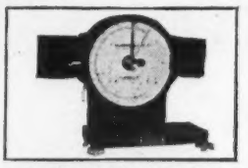
A Few Interesting Items from the ROLLER-SMITH Line of Apparatus


INSTRUMENT and CONTROL SWITCHES

THERMO-MAGNETIC RELAYS

CIRCUIT TESTERS

GRAPHIC INSTRUMENTS


PRECISION BALANCES

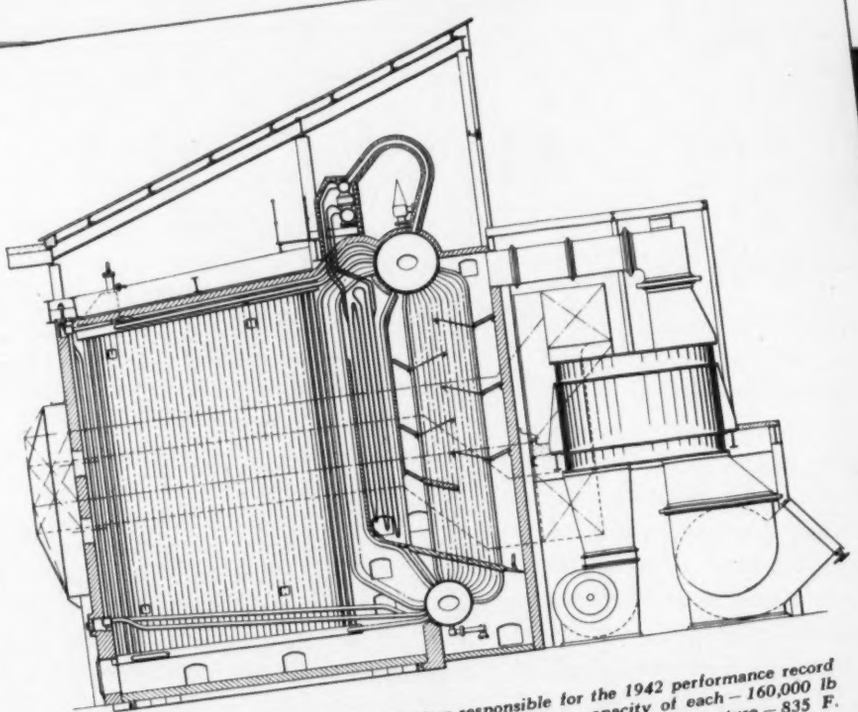
ROLLER SMITH

Electrical Measuring and Protective Apparatus

ROLLER-SMITH COMPANY BETHLEHEM, PENNA.

Switchboards • Metal Enclosed Switchgear • Electrical Instruments
Indoor and Outdoor Oil Circuit Breakers • Air Circuit Breakers

C-E VU UNITS ON THE POWER F



One of two identical VU Steam Generators responsible for the 1942 performance record described on the right-hand page. Maximum continuous capacity of each – 160,000 lb of steam per hr. Drum design pressure – 725 psi. Total steam temperature – 835 F.

ER PRODUCTION LINE...

92.4% OF THE TOTAL HOURS IN OUR FIRST YEAR OF TOTAL WAR

Labelled *The Victory Unit* many months ago by a member of our Engineering Department who was impressed by the number of these units going into war plants, Combustion Engineering's VU Steam Generator continues to prove itself worthy of the name. A case in point is an installation of two of these units, the sole source of steam supply in a Southwestern central station, which were on the line a total of 16,191 hours in 1942 — a combined "use factor" of 92.4 per cent.

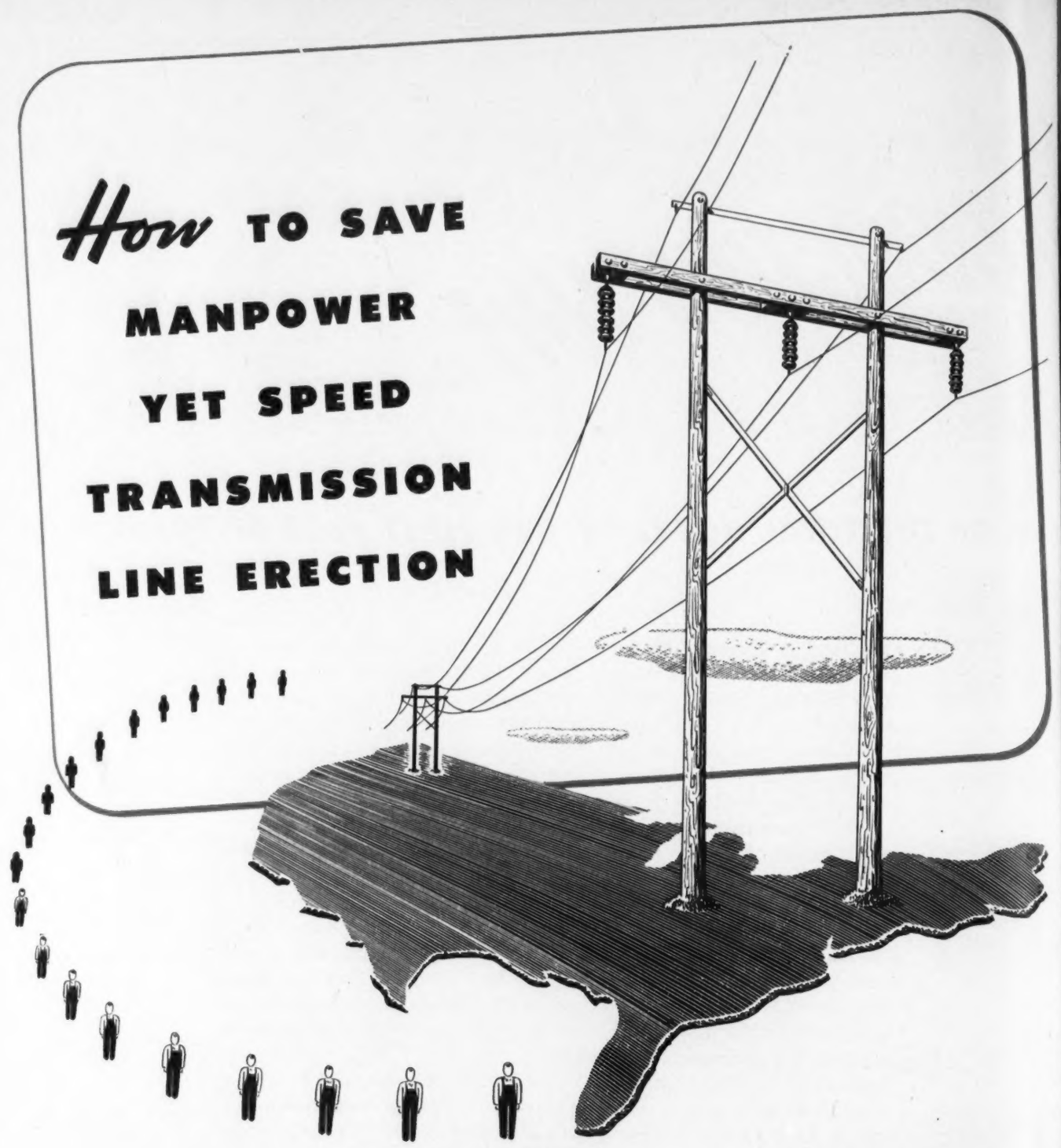
Steam generating equipment that can meet extraordinary service demands is one big reason for America's ever increasing war production. The VU Units in this central station, for example, are helping to supply a never-ceasing flow of electrical power to plants producing planes, shells, oil, gasoline, coal and essential food products. Not only did they do all that was asked of them in 1942, but they were ready to do even more as indicated by a combined "availability" of 96.1 per cent. They also gave a fine account of themselves on the score of efficiency with an average overall figure of 83.2% for the entire year — slightly better than the result expected under normal operating conditions.

Thus the utilities continue to demonstrate the war-time benefits of their peace-time policy which fostered continuous improvement of equipment to produce power more efficiently, more dependably and more abundantly. As a result, our public utilities at present are not only meeting the sharply increased power demands of the war, but are doing so with relatively little addition to existing facilities and without restrictions on civilian use. A-724

COMBUSTION ENGINEERING

200 MADISON AVENUE, NEW YORK, N. Y.

How TO SAVE MANPOWER YET SPEED TRANSMISSION LINE ERECTION



Throughout the country our trained men are ready to help you meet today's unprecedented demand for power. In the erection or maintenance of transmission lines . . . regardless of distance or terrain . . . Hoosier experience and special equipment guarantees efficient and economical service.

HOOSIER ENGINEERING CO.

COLUMBUS, OHIO

NEW YORK — CHICAGO

ERECTION and MAINTENANCE OF TRANSMISSION LINES

Regular MAINTENANCE of INSULATED WIRES AND CABLES HELPS CABLE PERFORMANCE

★ Insulated cables usually are purchased under specifications that provide for conductors, insulation and protection suitable and adequate for the service they are intended for. Satisfactory service then depends largely upon installation and maintenance. Careful handling, proper equipment and good workmanship will overcome most hazards of installation.

★ Proper design by experienced cable engineers, careful installation under expert supervision, followed by regular inspection and testing, are the best guarantees of satisfactory cable service. But, for the duration of the war, maintenance of cables already in service becomes the major factor in cable operation because new cables are difficult to get and most cable users have no spare cables to install.

★ Careful maintenance is vitally necessary if insulated wires and cables are to continue to function satisfactorily. Regular inspections at frequent intervals, to make sure nothing has happened or is developing to interfere with service, are a good investment. Prompt correction of any unsatisfactory condition will head off complaints and prevent cable failure.

★ In a recent folder entitled "Wire & Cable Maintenance and Conservation of Critical Materials" are a few suggestions designed to aid in keeping insulated wires and cables operating efficiently during the period when copper, rubber and other scarce materials can be used only for war orders and essential industries. We shall be pleased to send a copy to you if you are interested.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge, Mass.

Simplex WIRES and CABLES

If It's B.T.C. Forged

You Can Depend On It

Dependable in design—dependable in strength. B.T.C. is proud of its record in the transmission field, for where strength, lightness and uniformity is paramount, the decision to use a forging is universal practice. In the transmission field it's a B.T.C. forging.

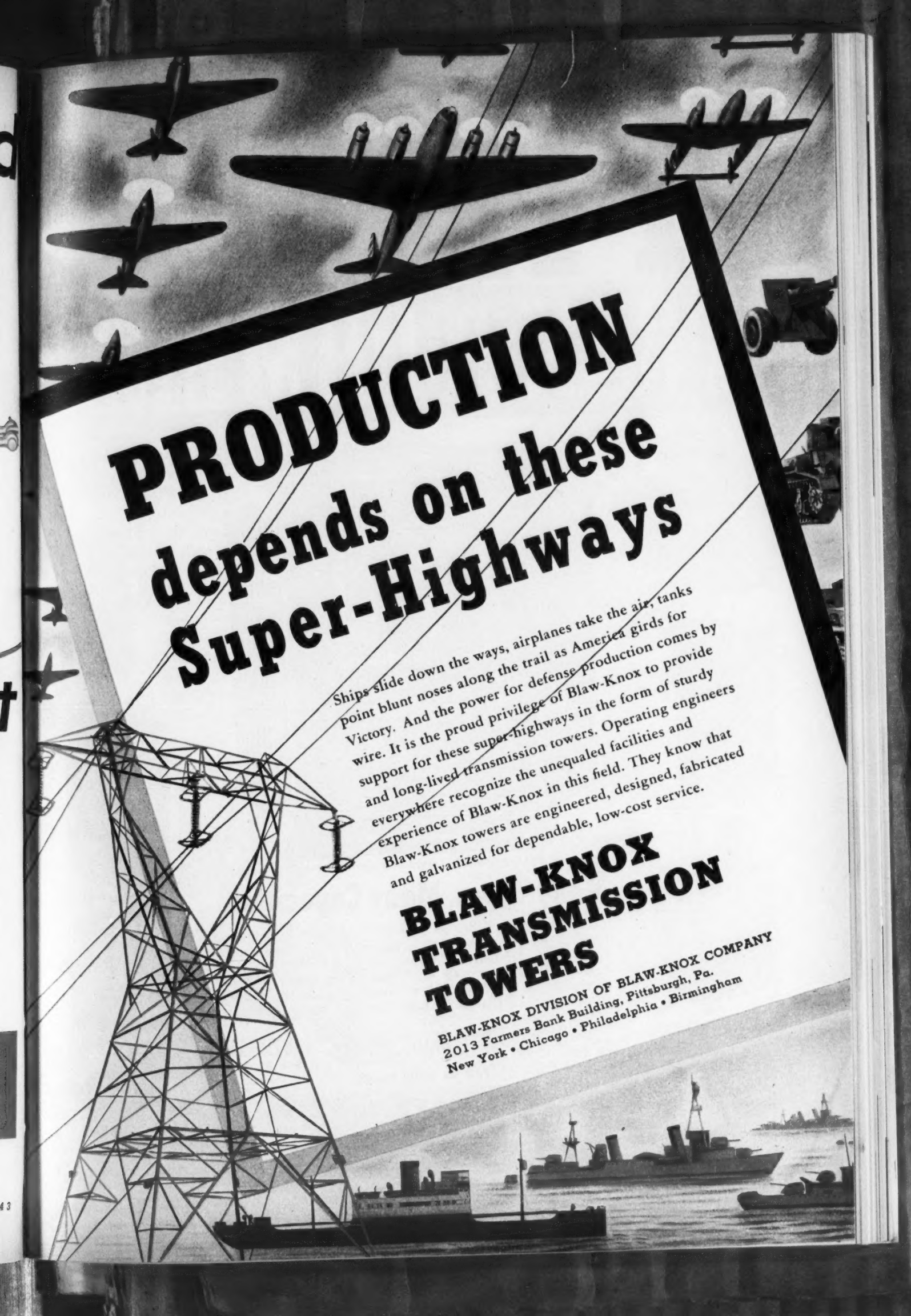
May we send you our Hi-Line Reference Book? It will prove a valuable working tool in your files.

BTC

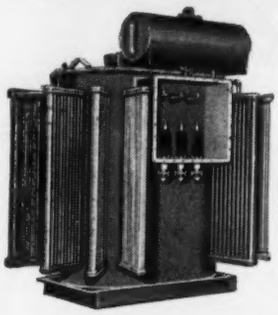
Through your Insulator Manufacturer only.

Forged Hi-Line Hardware

THE BREWER-TITCHENER CORPORATION
CORTLAND, NEW YORK

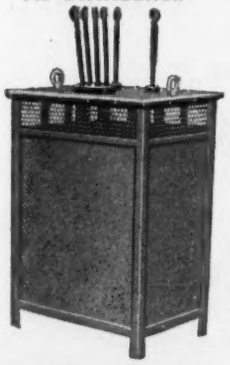

PRODUCTION
depends on these
Super-Highways
Ships slide down the ways, airplanes take the air, tanks point blunt noses along the trail as America girds for Victory. And the power for defense production comes by wire. It is the proud privilege of Blaw-Knox to provide support for these super-highways in the form of sturdy and long-lived transmission towers. Operating engineers everywhere recognize the unequaled facilities and experience of Blaw-Knox in this field. They know that Blaw-Knox towers are engineered, designed, fabricated and galvanized for dependable, low-cost service.
BLAW-KNOX
TRANSMISSION
TOWERS
BLAW-KNOX DIVISION OF BLAW-KNOX COMPANY
2013 Farmers Bank Building, Pittsburgh, Pa.
New York • Chicago • Philadelphia • Birmingham

UPTEGRAFF
TRANSFORMERS



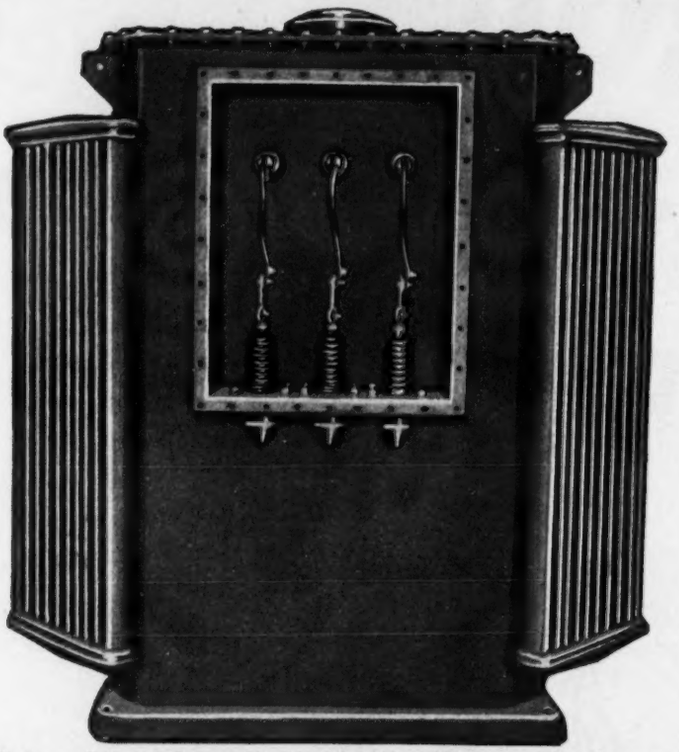
Power

AD Distribution

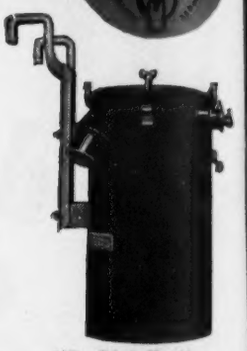


DA Dry Type

CR Current

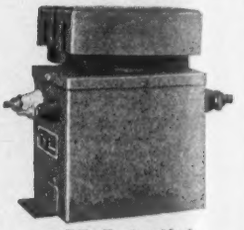


Uptegraff Non-Inflammable Liquid (Askarel) Power Transformer



UD Distribution

CSP Distribution



PR Potential

E Dry Type

Many Types, Many Capacities

There is a sureness of service in Uptegraff Transformers of every type, that has won them high respect from Utilities, Contractors and Power Users.

Built in a modernly equipped plant devoted entirely to Transformers, and with engineering and production facilities to take care of many special requirements.

All Uptegraff Transformers are built in strict accordance with the standards of NEMA, of AIEE, of EEI, and of ASA.

Tell us your needs.

R.E. UPTEGRAFF *Manufacturing Co.*

SCOTTDALE • • • PENN'A • U.S.A.

OPEN WIRING

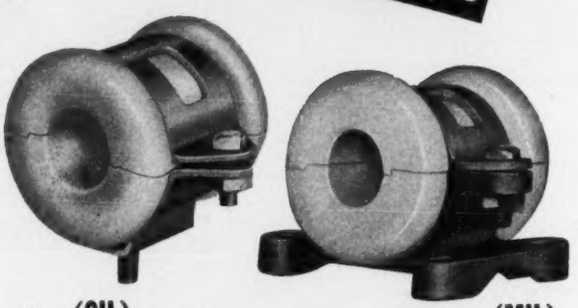
A BIG ADVANTAGE FOR MAKING QUICK, DEPENDABLE, FLEXIBLE INSTALLATIONS . .

★ This method of rigidly supporting cables is simple as can be. It affords extreme flexibility, safety, and neatness. There is much less cost to making an installation and *you save delays in securing critical materials* such as where conduit or duct is used. You can plan on installing these cables immediately if you plan on using "THREE E" Clamp Insulator Supports.

A complete line of multiple conductor supports in triangular configuration are available for single bolt and double bolt flat mounting, pipe mounting and H and I beam mountings. Multiple conductor supports containing any desired number of conductors can be supplied grouped on channel bases. Write for your copy of Bulletin No. 201.

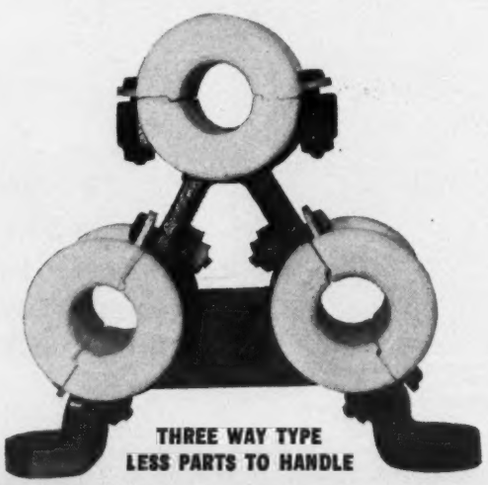
The supports are built and recommended for either AC or DC service.

"Three E" CLAMP INSULATOR SUPPORTS
Single and Multiple Types

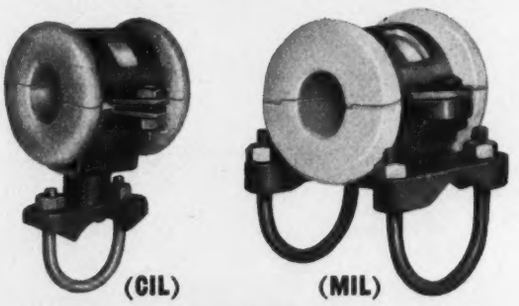


(CIL) (MIL)

FLAT MOUNTING TYPES



THREE WAY TYPE
LESS PARTS TO HANDLE



(CIL) (MIL)

PIPE MOUNTING TYPES

ELECTRICAL ENGINEERS EQUIPMENT CO.
MELROSE PARK ILLINOIS

In time of war and in time of peace . . .

Wagner

TRANSFORMERS

reflect sound engineering and modern manufacturing methods . . .

POWER
★
DISTRIBUTION
★
AIR-COOLED
★
NOFLAMOL
(NON-INFLAMMABLE LIQUID FILLED)

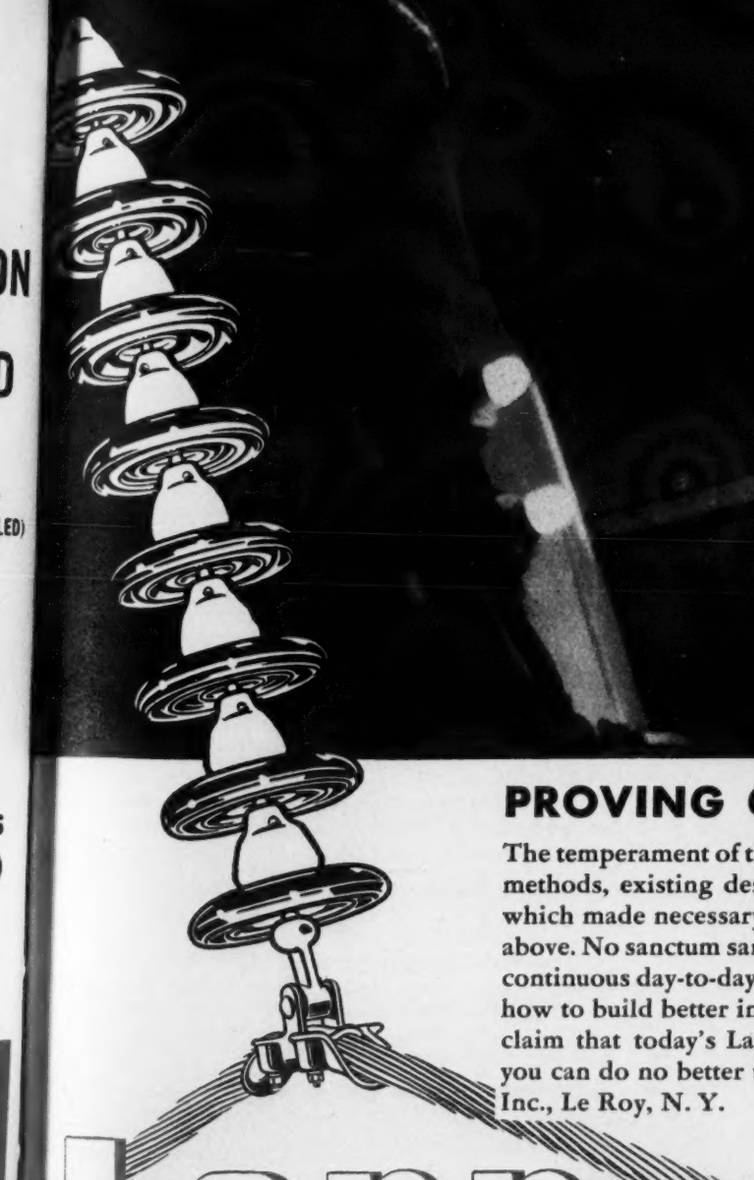
★

Write
FOR BULLETINS
TU-33 (NOFLAMOL)
TU-181 (POWER)
TU-180 (DISTRIBUTION)

T43-3

Wagner Electric Corporation
ESTABLISHED 1891
6400 Plymouth Avenue, St. Louis, Mo., U. S. A.
ELECTRICAL AND AUTOMOTIVE PRODUCTS

T'S THE *PORCELAIN* THAT INSULATES



PROVING GROUND FOR INSULATORS . .

The temperament of the Lapp organization is that of dissatisfaction with existing methods, existing designs. It is this spirit which produced the Line Post and which made necessary the Lapp laboratory, a corner of which is photographed above. No sanctum sanctorum, this laboratory is truly an engineers' workshop, in continuous day-to-day use, testing, discarding, proving new designs. As we learn how to build better insulators, we build them. Meanwhile, we feel secure in our claim that today's Lapp insulators are adequately suited to today's needs, that you can do no better than to insulate your lines with Lapp. Lapp Insulator Co., Inc., Le Roy, N. Y.

Lapp

Better Porcelain • Better Insulators

Want to help

"WHY CAN'T I EVER FIX THINGS?"

Don't forget, lady, your electric appliances are precision-built for long life and maximum service. They were put together by experts and they must be repaired by experts. That's why it is wiser and more economical to call on a skilled specialist at once.

The General Electric Appliance Service man has the "Know-how," the necessary replacement parts and the proper tools. In addition, he can give you a lot of good advice on the proper use and care of your appliances.

You'll soon be seeing this illustration and text as one of a series of General Electric Consumers Institute advertisements appearing in National Women's Service magazines. It's part of the story, your story, G-E is telling to Mrs. America.

STRAIGHT THINKING
The story of the Appliance and Merchandise Dept. of
GENERAL ELECTRIC
and its counter-dealer relations
WHAT WE HAVE DONE
WHAT WE ARE DOING
WHAT WE PLAN TO DO

Ask to See "Straight Thinking"

The story of G-E's wartime program planned to *help* you. Includes a lot of darned interesting ideas—for instance, the complete set-up of this year's new advertising campaigns that have been planned for *1943* needs. Get your G-E Distributor to show you a copy of "Straight Thinking." It'll help.

LOOK FOR THESE G-E CONSUMERS INSTITUTE ADS IN THESE MAGAZINES WHICH APPEAR ON NEWSSTANDS IN APRIL

These G-E Consumers Institute Advertisements are but a part of the company-wide General Electric advertising schedule.

Saturday Evening Post ..... April 10
Collier's ..... April 10
Look ..... April 6
New York Times Magazine ... April 18

American Home . May	Ladies Home Journal May
House Beautiful . May	Good Housekeeping . May
Holland's ..... May	Country Gentleman .. May

WAR BONDS WILL BUILD AND EQUIP NEW

a Lady in Distress ?

HERE'S HOW WE'LL HELP YOU HELP HER

G-E SERVICE SCHOOLS

Attendance in early 1943 schools topped all previous records! Features include new full-color movie, sound slide films, demonstrations with practical repair and maintenance instruction. Ask your G-E Distributor for complete details on next sessions, or write to the Product Service Section, General Electric Company, Bridgeport, Conn.

SERVICE STORE DISPLAY

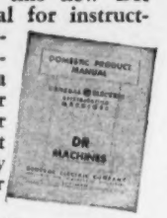
Made in two parts (you can detach the Appliance Service Center Dealer Section and use it separately if you wish). It's a big display—4 ft. high and over 2 ft. wide. For floor and window use. Puts the spotlight on your store as Appliance Service Headquarters—Price only $1.50 each, postpaid. Order yours from your G-E Distributor or write for information to Adv. Div., General Electric, Bridgeport, Conn.

SECRET OF SUCCESS

Ask any successful Appliance Serviceman this question: "What is most helpful to you in your business?" Invariably his answer is: "THE PRODUCT MAN." For over 14 years this publication (issued monthly by G-E's Appliance and Merchandise Department) has been the direct link between the factory and the field servicemen. Each issue contains 25 to 30 pages of "work-facts" and "know-how" on servicing G-E Appliances. Only $1.50 a year. If you're not a subscriber, get on the list today, through your G-E Distributor. Ask him, too, about yearly volumes bound in heavy duty covers for only $2.00 per copy.

NEW "KNOW-HOW" HANDBOOK

Here's practically a new, just-off-the-press service manual that tells all you ever need to know about servicing the famous DR type General Electric sealed refrigerating units. You'll find this new DR Manual ideal for instructing new service personnel, and a fast refresher course for veterans. Get your copy through your Distributor.



HERE'S HOW YOU CAN HELP HER

BUSINESS BOOSTER!

Maybe she'll insist, anyway, on trying to make minor cleaner repairs herself. You can be of real service to these home-mechanics if you stock and display the genuine G-E Cleaner Parts Kits. Each Kit contains an assortment of vital parts, such as brushes, wheels, belts, springs and many others. Get complete information today from your General Electric Cleaner Distributor.

FIRST AID FOR FANCY FINISHES

Next time a worried housewife asks you about protecting the painted finish on her appliances, tell her about G-E Liquid Wax. Ideal for all synthetic surfaces. (For Porcelain? No-o-o!) G-E Liquid Wax comes in full pint cans. Nice, eh!

REPLACEMENT PARTS

G-E has a replacement stock pile that's 98% complete. Don't let your stock of replacement parts get low. Send in old appliance parts. Old ones make new ones in wartime.

THE G-E CONSUMERS INSTITUTE

Tell her how the G-E Consumers Institute is carrying on constant research on such wartime home problems as Nutrition, Food Preparation, Appliance Care and Repair, Laundering, Home Making. Tell her about the General Electric Consumers Institute booklets and bulletins. Favorites are:

A Captain In The Kitchen

How To Get The Most Out of the Food You Buy

Pack A Lunch That Packs A Punch

Keep It Working folders

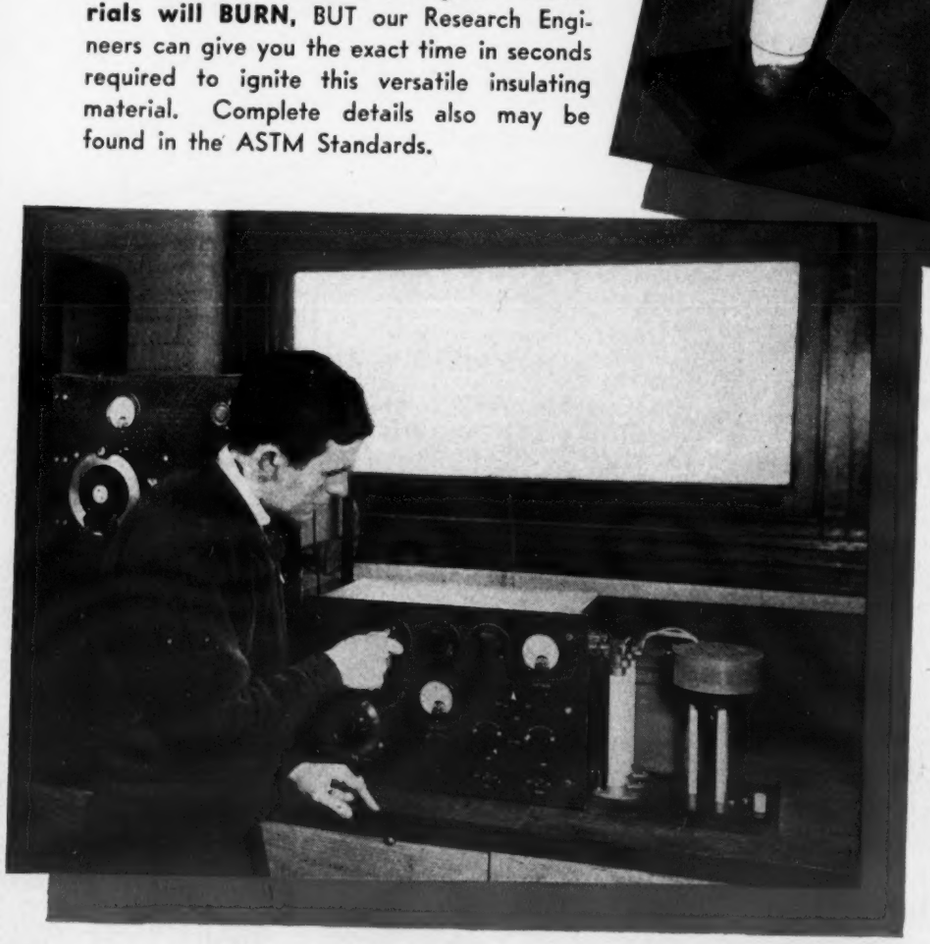
Get samples and prices from your G-E Distributor or write to the General Electric Consumers Institute.

GENERAL ELECTRIC

VICTORY HOMES TOMORROW!

. . . C-D's CUSTOMERS

YES, DILECTO like all organic materials will BURN, BUT our Research Engineers can give you the exact time in seconds required to ignite this versatile insulating material. Complete details also may be found in the ASTM Standards.



DESIGNED for 15 KV . . . REQUIRES 52 KV to CAUSE FLASHOVER. Shown above is a Dilecto Oil Circuit Breaker Bushing for indoor use. While intended for a breaker of 15 KV, 1200 Amp. rating, specifications called for no flashover between mounting collar and terminals at a voltage under 50 KV. C-D Engineers made certain it took 52 KV to cause flashover.

At left is a precision instrument for measuring the power factor and dielectric constant of solid dielectrics. Every grade and thickness of Dilecto gets a control check on this device.

GET THE ANSWERS

In one of America's most complete research laboratories a staff of specialists in both electrical and physical insulation devote their skills to finding out "What happens?". Their reports and recommendations are passed on to manufacturers so that they can accurately predetermine the performance of their products, enabling them to save time and money, and build prestige.

Continental-Diamond's engineers are working now on "The Shapes of Things to Come". If you are planning on product improvements that might be speeded by the use of a C-D NONmetallic we suggest that this is the time to avail yourself of C-D facilities and experience.

●

C-D PRODUCTS

DILECTO A laminated plastic. High in electrical insulating properties. Of great structural strength. Resistant to moisture to a high degree. Readily fabricated to special shapes from basic standard forms of sheets, rods and tubes.

DIAMOND VULCANIZED FIBRE is a hard, dense, bone-like material . . . tough, pliable and strong. It is light in weight yet mechanically strong and will not deteriorate under constant mechanical strain.

MICABOND Here is mica in its most usable form. The high heat resistance of mica and its high dielectric strength are almost completely preserved in MICABOND plate, flexible sheets, tape, tubing and punched and formed parts.

VULCOID A product of Continental-Diamond's manufacturing experience and laboratory research. A material that offers a combination of the properties of Dilecto and Diamond Vulcanized Fibre.

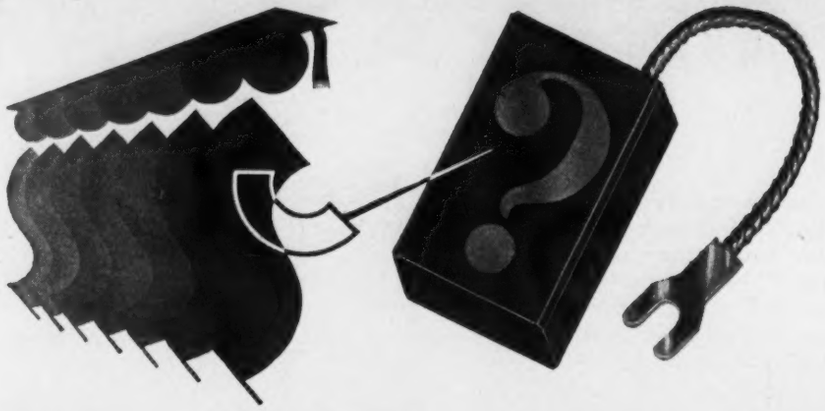
CELORON A molded mascerated fabric base plastic that is also readily machined. CELORON combines to a high degree the desirable properties of impact strength, tensile strength, dielectric strength, moisture resistance, heat resistance and dimensional stability.

●

The above photograph shows a conventional hat molding press being used for experimental molding of laminated materials, at low pressure. The part which has just been removed from the mold is a low pressure phenolic laminated aircraft engine baffle.

Continental-Diamond FIBRE COMPANY

Established 1895 — Manufacturers of Laminated Plastics since 1911 — NEWARK, DELAWARE



BRUSH PROBLEMS DON'T STAY ANSWERED

. . . because Stackpole Engineering Progress makes yesterday's developments out-of-date today

CHECK THIS LIST AGAINST YOUR NEEDS

Brushes • Anodes • Bearings • Brazing Blocks • Brake Lining • Electrodes • Packing, Piston, and Seal Rings • Pipe • Rheostat Plates and Discs • Welding Rods, Electrodes and Plates, etc.

. . . also All Carbon, Graphite, Metal and Composition Contacts

STACKPOLE ELECTRONIC COMPONENTS

Fixed and Variable Resistors
Iron Cores • Switches

It pays to check brush requirements for all types of rotating electrical equipment at frequent intervals against the latest that Stackpole engineering may have to offer.

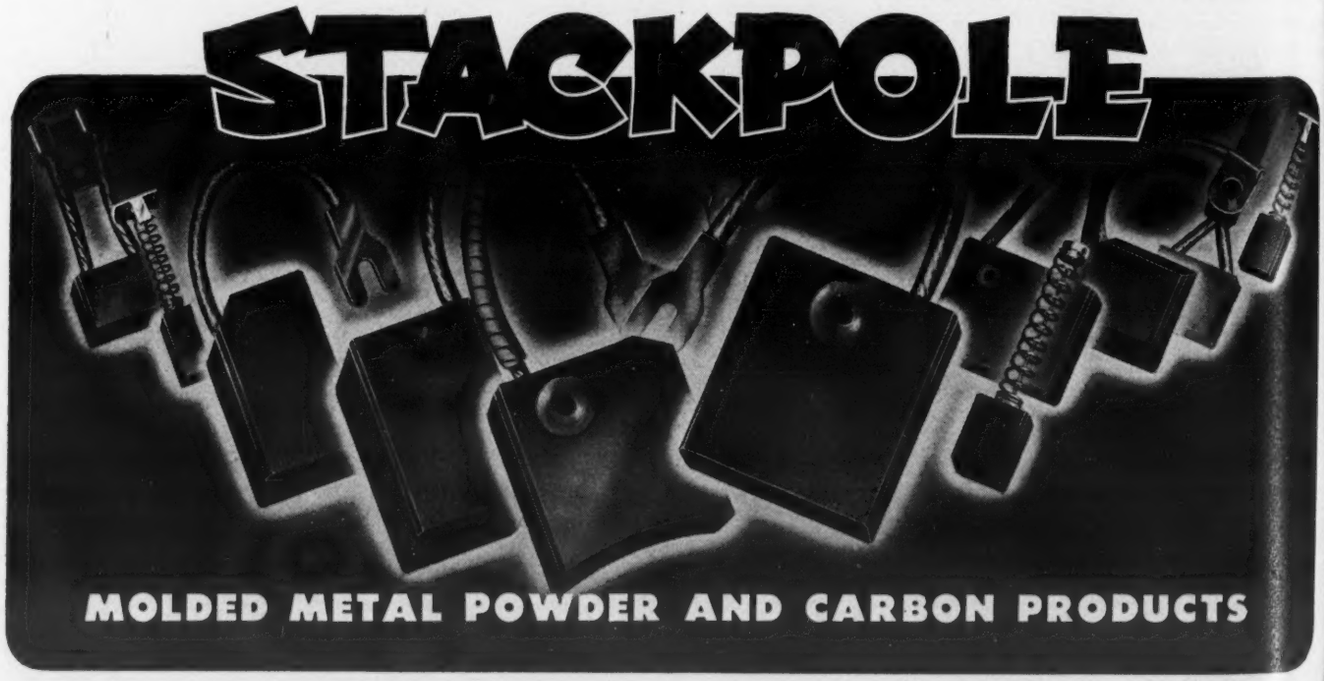
Why? Well, simply because brush engineering is a fast-moving business, and Stackpole engineering is the fastest-moving of all.

One after another, over a period of years, Stackpole brush developments have been matching the need for higher speed operation, better commutation, and higher capacity. Today, under impetus of war requirements, this work has been greatly intensified and broadened into new fields such as brushes for high-altitude work and various others.

All of which means that brush problems don't stay answered. What might have been good enough before, may no longer be good enough by comparison with recent Stackpole developments.

Stackpole brushes are sold only to manufacturers of original equipment. Inquiries will receive prompt attention.

STACKPOLE CARBON COMPANY, ST. MARYS, PENNSYLVANIA



more juice to old friends

WE can't get around to see you these days as often as we'd like, because of the manpower shortage. But we do want very much to keep in touch with you. One way we can do this is through MORE JUICE.

Maybe you are already on the free mailing list of this pocket size monthly, and get a mild kick out of it, along with a fresh idea now and then.

On the other hand, if you fill out the coupon at the bottom of the page, here's what you are letting yourself in for:

An unpretentious little publication with no product advertising, and a minimum of tripe. It kicks off regularly with some burning question that burns us up. You too, probably.

There's good-natured kidding between Reddy, whose ugly young mug is shown above, and the Vice-President in charge of Service, and of Sales—when we are free to make them! In the Give and Take Dept. readers can air a peeve or share a swell idea. A cartoon, known as Passing Smiles, is enclosed with each issue.

It aims to keep out of your waste basket for the five or seven minutes it takes to read.

About 15,000 fellows in Electrical Wholesaling and in industry generally, get it regularly—at home or in the Service. To start with the next issue, mail the coupon today.

MORE JUICE has never been advertised before. Frankly the only reason we're doing it now is to keep up with old friends.

T&B

ORDER YOUR ELECTRICAL REQUIREMENTS *at least* 4 MONTHS AHEAD!

THE THOMAS & BETTS CO.
INCORPORATED
MANUFACTURERS OF ELECTRICAL FITTINGS SINCE 1899
ELIZABETH, NEW JERSEY
In Canada: Thomas & Betts Ltd. Montreal

Shall we shake hands on this?

Reddy Fitter
c/o Thomas & Betts Co.
Elizabeth, New Jersey

Please put me on the complimentary mailing list for MORE JUICE.

Name.....
(Nick name, if you like)

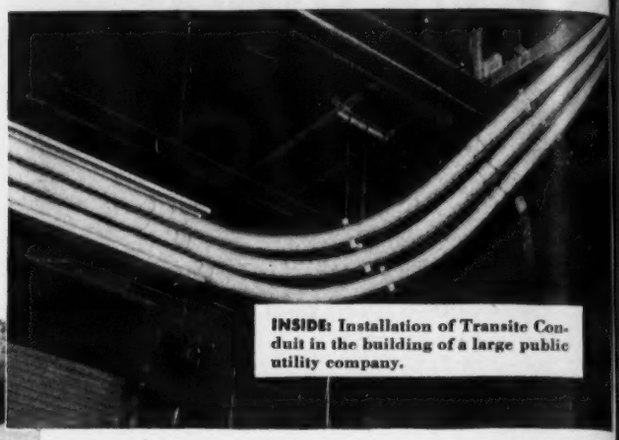
Address.....
(Home, if you like)

Company.....

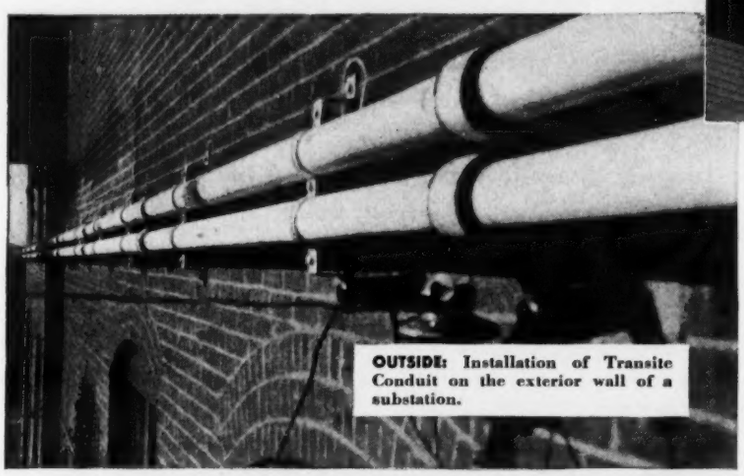
WPB Order L-225 does not apply to this modern type of Conduit...

when used Inside, Outside or Underground

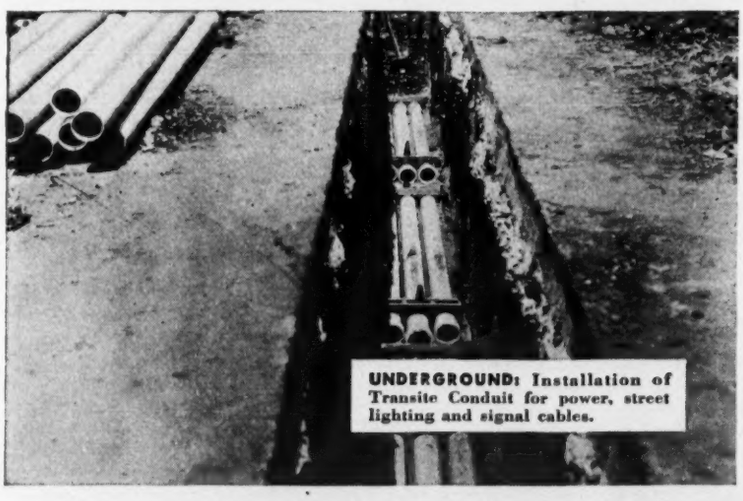
J-M TRANSITE CONDUIT is a non-metallic duct offering strength, incombustibility, permanently smooth bore, elimination of electrolysis problem and ease of installation . . .



INSIDE: Installation of Transite Conduit in the building of a large public utility company.



OUTSIDE: Installation of Transite Conduit on the exterior wall of a substation.



UNDERGROUND: Installation of Transite Conduit for power, street lighting and signal cables.

CURRENT RESTRICTIONS imposed by General Limitation Order L-225 on the manufacture, delivery and installation of electrical conduit, tubing and raceways—do *not* apply to Johns-Manville Transite Conduit when used inside, outside or underground.

This modern type of Conduit offers many advantages for use in fire and traffic signal systems, private right-of-way installations, and underground service connections to residential and commercial buildings.

Transite Conduit is so strong that it needs no protective casing underground; withstands earth loads and traffic pressure. When "concreting in," use Transite Korduct—thinner-walled, lower-priced, otherwise identical with Conduit.

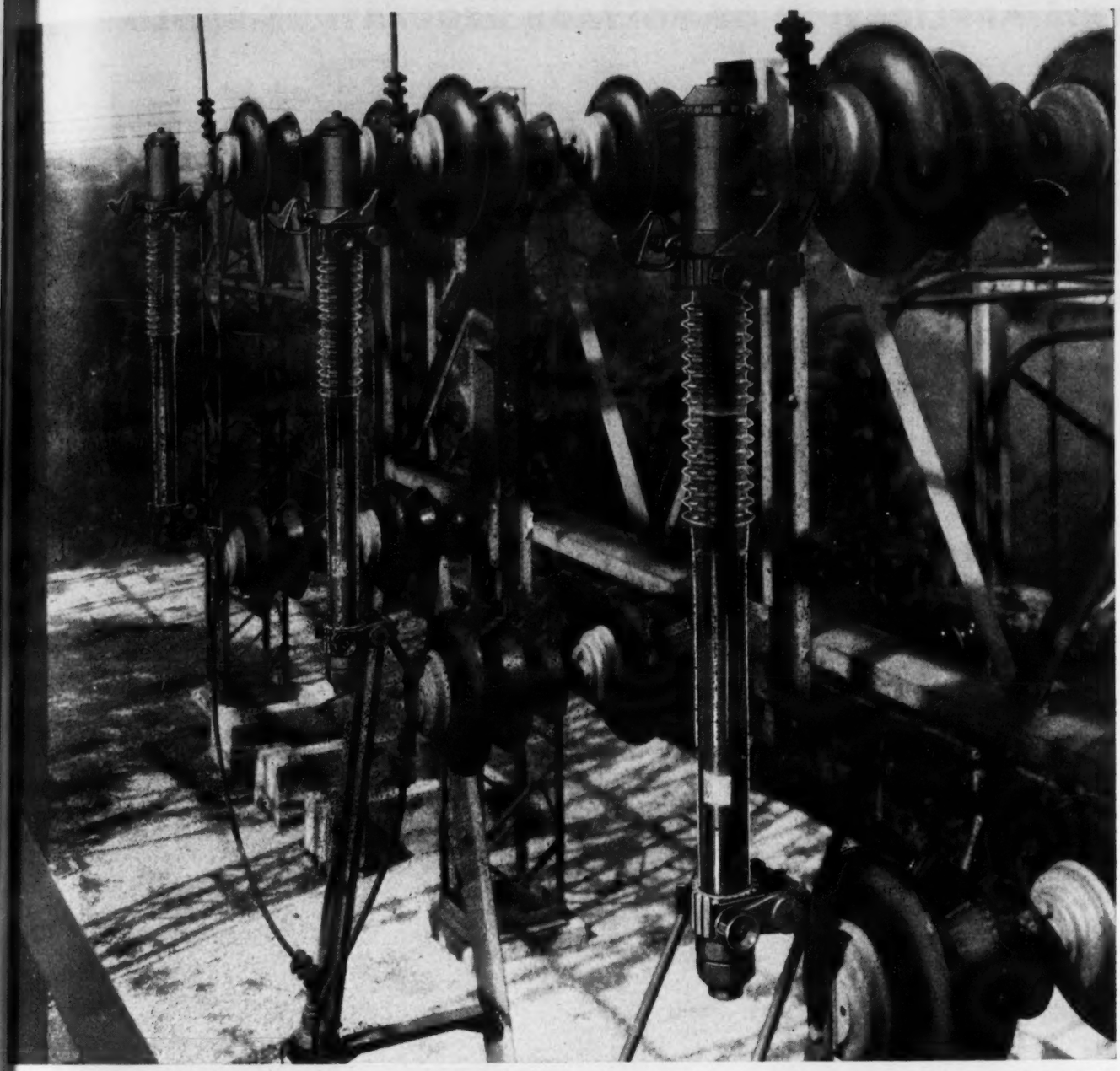
For complete details on J-M Transite Ducts, write for Data Book DS-410, Johns-Manville, 22 East 40th Street, New York, N. Y.

Johns-Manville

TRANSITE DUCTS

TRANSITE KORDUCT— for installation in concrete

TRANSITE CONDUIT— for exposed work and installation underground without a concrete encasement



ECONOMICAL SUBSTATION PROTECTION

S & C Type SMG Fuses Also Cut Use of Critical Metals

For safe, dependable protection of transmission substations for power companies, large ordnance and war production plants,—substations up to 138 KV,—S & C Type SMG Power Fuses have many advantages. They have short circuit interrupting ratings up to 1,000,000 KVA, require relatively little space, and are simple to service. Their use saves tons of critical metals—steel, copper.

These fuses are not destroyed when they operate, but may be put back in service immediately by simply replacing the re-fill unit on the job. The fuse tube remains intact. Being available in capacities of 1 to 400 amperes,—46,000 to 138,000 volts,—they cover a wide range of applications.

S & C engineers experienced in the field of protective equipment are ready at all times to make recommendations. Save time by availing yourself of this service. SCHWEITZER & CONRAD, INC., 4435 Ravenswood Avenue, Chicago, Illinois.

TYPE SMG
POWER FUSES

THIS APPLICATION OF VOLTAGE REGULATORS COULD SAVE

21 tons of copper for Uncle Sam

Located five miles from the nearest substation but only a stone's throw from an existing 66 kv transmission line, this war plant needs power for a 5000 kv-a load. Today, Uncle Sam urgently needs the 42,300 pounds of copper that will be saved if power is obtained directly from the high line.

To put up 13.8 kv transmission lines of 4/0 conductor from substation to plant would require about 50,700 pounds of copper.

By obtaining power from the high line near the plant through installation of a transformer, circuit breaker and voltage regulator—only 8,400 pounds of copper will be needed.

42,300 pounds of copper—more than 21 tons—is the saving contributed by this application of a voltage regulator. Apply voltage regulation wherever practical to avoid construction of new lines, parallel lines and heavier lines. Westinghouse Electric & Mfg. Company, East Pittsburgh, Pa. J-10236

Westinghouse builds a complete line of feeder voltage regulators for all types and sizes of distribution lines. Step type regulators (illustrated) for outdoor service . . . liquid-cooled induction type regulators for outdoor and indoor service . . . air-cooled regulators for indoor service.

Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

VOLTAGE REGULATORS

KAPPA

Trade Mark Reg. U. S. Pat. Off.

CELLULOSE-ACETATE RAYON
COIL WINDING TAPES

- HIGH DIELECTRIC
- LOW POWER FACTOR
- ECONOMY IN VARNISHING
- LOW MOISTURE ABSORPTION
- FAST DRYING
- HIGH DRY TENSILE STRENGTH
- LOW COST

IMMEDIATELY AVAILABLE IN ANY QUANTITY
standard tape widths and mil thicknesses, also special widths

A FINER PRODUCT . . .

. . IMMEDIATELY AVAILABLE AT LOW COST

When we developed the new KAPPA Cellulose Acetate Rayon Coil Winding Tapes we were determined to produce a superior tape that would be easier and more economical to use and at the same time would assure highest electrical efficiency and superior finish in the wound coils.

We are satisfied that KAPPA Tapes more than fulfill our rigid specifications. Their construction of woven Cellulose Acetate Rayon *fabric* contributes to ease in winding by machine or hand. The tested and proved superior physical and electrical properties of KAPPA Tapes make them ideal for electrical use...yet they cost no more...and often less...than materials previously used for equivalent qualities of work.

And most important today, KAPPA Tapes are available for *immediate delivery* in unlimited quantities. Full information, including detailed results of tests made by Prof. J. C. Balsbaugh of Cambridge, Mass., is contained in our new KAPPA BULLETIN. We will be glad to send you a copy together with long length test samples on request. Please state width and mil thickness of tape you use. Wm. E. Wright & Sons Company, Industrial Textile Division, Box 1000, West Warren, Mass.

Complete test and Technical Data and prices in this new Bulletin. Free on request.

The Wright tape for every winding..

KAPPA

ENGINEERS!
CHECK THESE SIX OUTSTANDING FEATURES OF NEW

1 MINIMUM FREQUENCY DRIFT

Absence of hot flow and cold flow, maximum dimensional stability and minimum expansion combine to provide a minimum of frequency drift. Often it is not necessary to use crystals or other compensating devices.

2 NEGLIGIBLE WATER ABSORPTION

Multiform glasses show a water absorption of less than 0.01 per cent (24 hours). Impregnants or added glazes are unnecessary, assuring better dimensional tolerances. Loss of efficiency due to improper impregnation or cracked glaze is eliminated.

3 LOW LOSS FACTOR

Insulators, made from Multiform glasses, offer you definitely greater efficiency. Multiform glass #707, for example, has a loss factor of only 0.40 at 20°C,—1 Meg.

4 UNIFORM ACCURACY

Threads, grooves and holes are accurate from piece to piece because they are molded in the piece. All sizes can be made with tolerances of ±2.0%, not less than ±0.010".

5 EXTREMELY WIDE RANGE OF SIZES AND SHAPES

There's almost no limit on shapes, cylindrical or flat. In size, pieces range from tiny beads, several thousand to the pound, to 25-lb. pieces 15" or more across.

6 HIGH DIELECTRIC STRENGTH

Multiform glasses have a dielectric strength of 500 volts per mil or more—approximately twice the dielectric strength of porcelains and steatites.

CORNING MULTIFORM GLASS INSULATION

NO SHORTAGE OF GLASS TO REPLACE STEATITE, PORCELAIN AND OTHER ELECTRICAL INSULATION MATERIALS

DELIVERIES slow on electrical insulators? Here's good news! New-type insulators developed by Corning Glass Research—Pyrex brand Multiform Glassware—are available now! Check the six outstanding features on the opposite page. See why all Multiform glasses not only comply with the proposed A.S.A. American War Standard on Radio Insulation Materials of Low Dielectric Constant, but actually offer you more in efficiency and long life!

The characteristics of these glasses plus Corning's new fabrication methods make possible an extremely wide range of shapes and sizes. General dimensional tolerances are: large or heavy pieces, intricate shapes, hollow cylindrical sections— ± 2.0% or 0.010"; flat plates, solid rods, discs, beads, bushings— ± 1.0% or 0.005", except thickness which should be ± 4% or 0.005".

If you have an insulator problem, do this today: Fill in and mail the coupon now for a free sample of Pyrex brand Multiform Glass and complete, descriptive booklet.

MAIL COUPON TODAY FOR FREE SAMPLE AND DATA!

Corning Glass Works, Corning, N. Y.
Insulation Division, Dept. W-31

Please send me immediately, without charge, sample and descriptive booklet on new Pyrex brand Multiform Insulators.

Name.....

Company.....

Street Address.....

City.....*State*.....

Pyrex Insulators
BRAND

"PYREX" is a registered trade-mark and indicates manufacture by Corning Glass Works

PRACTICAL HELP

FOR KNOTTY PROBLEMS THAT NEED QUICK ANSWERS

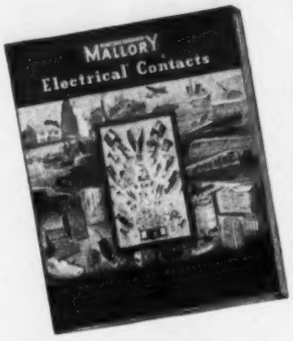
Your Questions on— Electrical Contacts Resistance Welding Current Rectification Electronic Components

Mallory has condensed "know-how" in books like these to help you find practical solutions to problems involving the selection of electrical contacts, welding processes and electrodes, current rectification, AC and DC power supplies, and industrial electronic components.

With the exception of the MYE Technical Manual, which is priced at $2.00, these books are yours for the asking. They may help break a development bottleneck, improve a product or process, and lower costs. Write us.

P. R. MALLORY & CO., Inc.
INDIANAPOLIS INDIANA
Cable Address—PELMALLO

P.R. MALLORY & CO. Inc.
MALLORY
APPROVED
PRECISION PRODUCTS



"ELECTRICAL CONTACTS"

Complete, concise presentation of contact material data in convenient and readily usable form. Contact design is authoritatively covered as an indispensable factor for consideration. Also reviewed are facings, inlays, spring materials and general availabilities.

"RESISTANCE WELDING"

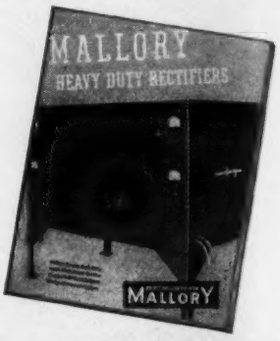
A 78-page book, treating subjects of spot, projection, roller seam, and butt and flash-butt welding, as well as properties and characteristics of various welded metals. Miscellaneous tables and application data on Mallory alloys are included.

"MYE TECHNICAL MANUAL"

A 408-page, hard-bound book with complete data on capacitors, noise suppression, receiving tubes, loudspeakers, television, frequency modulation, vibrators, phono-radios, automatic tuning, and other useful information. Priced at $2.00 per copy, net.

"APPROVED PRECISION PRODUCTS"

Descriptions, prices and specifications on potentiometers, rheostats, station selector and special switches, phone jacks and plugs, dial light assemblies, cable connecting devices, resistors, condensers, vibrators, rectifiers and battery chargers.



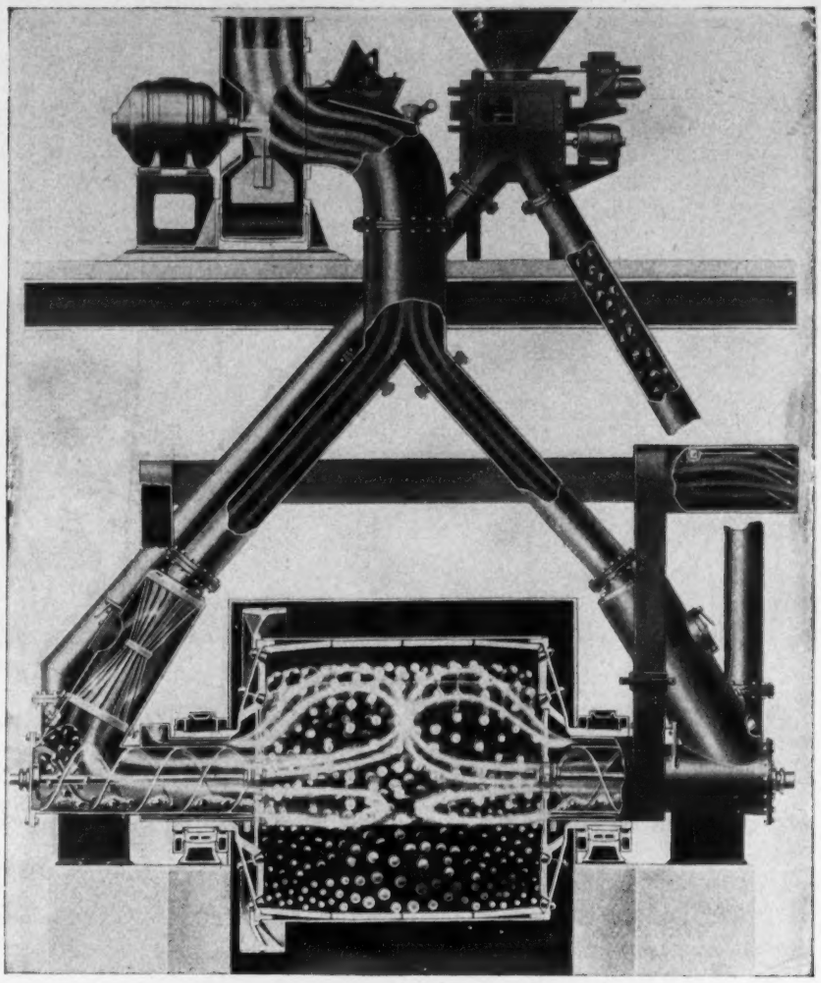
"HEAVY-DUTY RECTIFIERS"

General description of rectifiers in conjunction with advantages, applications, fundamentals of designing a power supply, special rectifier calculations. Supplemented with line drawings, charts and tables for easy understanding.

"VIBRAPACKS"

Complete information on vibrator power supplies for operating radio receivers, transmitters, public address amplifiers, direction finders and other apparatus where a source of commercial alternating current is not available.

In War and Peace



FOSTER WHEELER BALL MILLS

(Hardinge Type)

The Army-Navy Production "E" has been awarded to Foster Wheeler in recognition of quality equipment, in quantity, on time.

SAVE COAL

High fineness can be continuously maintained independent of wear *while mill is in service*. Lower carbon loss, more accurate combustion control, and less coal per lb. of steam combine for higher efficiency.

SAVE LABOR

Low speed, rugged construction, and simplicity of design insure least maintenance.

SAVE TIME

Operating records while steam generating units are in service show availability of 98-100% thus minimizing boiler outages attributable to pulverizer failure.

FOSTER WHEELER CORPORATION • 165 BROADWAY • NEW YORK, N. Y.

FOSTER FW WHEELER

THE LENGTH OF THE LINE MEASURES THE LOSS OF GOODWILL

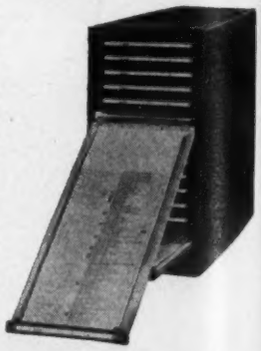
● In front of a counter, outside an office door, making application for service, Americans everywhere are standing in line. They're doing it because they realize they have to. They're doing it *but they're not liking it.* Slowness and inefficiency of operation due to lack of help are placing in jeopardy the most valuable asset a business can have — the goodwill of its customers.

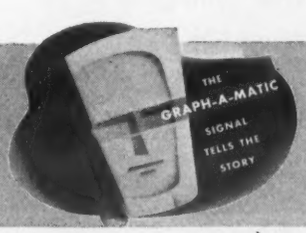
Key executives all over the country have met this vital problem of manpower shortage. They've met it and they've licked it with Kardex visible record control systems. For Kardex is designed not only for efficient maintenance of important records, not only to place at your fingertips a clear, predigested picture of operation progress, but to do that job with greatly curtailed or inexperienced help... easily, rapidly, accurately! And that all adds up to better service!

In the Public Utility field, Kardex has enabled insufficient personnel to reach a new high in giving customers the satisfaction of efficient service. Customer service records, customer histories, appliance service data, and sales records — all produce the required information faster with Kardex records. And in maintaining constant inventory control of high priority electrical materials, Kardex promptly signals the need for executive action. Kardex has helped thousands of organizations to meet the problem of inadequate, untrained help. Let Kardex do the same for you!

A Remington Rand Systems and Methods Engineer is ready to serve you. He and his associates have installed Kardex Systems that have successfully met an infinite number of record control problems. Call your nearest Remington Rand office today for his competent counsel and assistance!

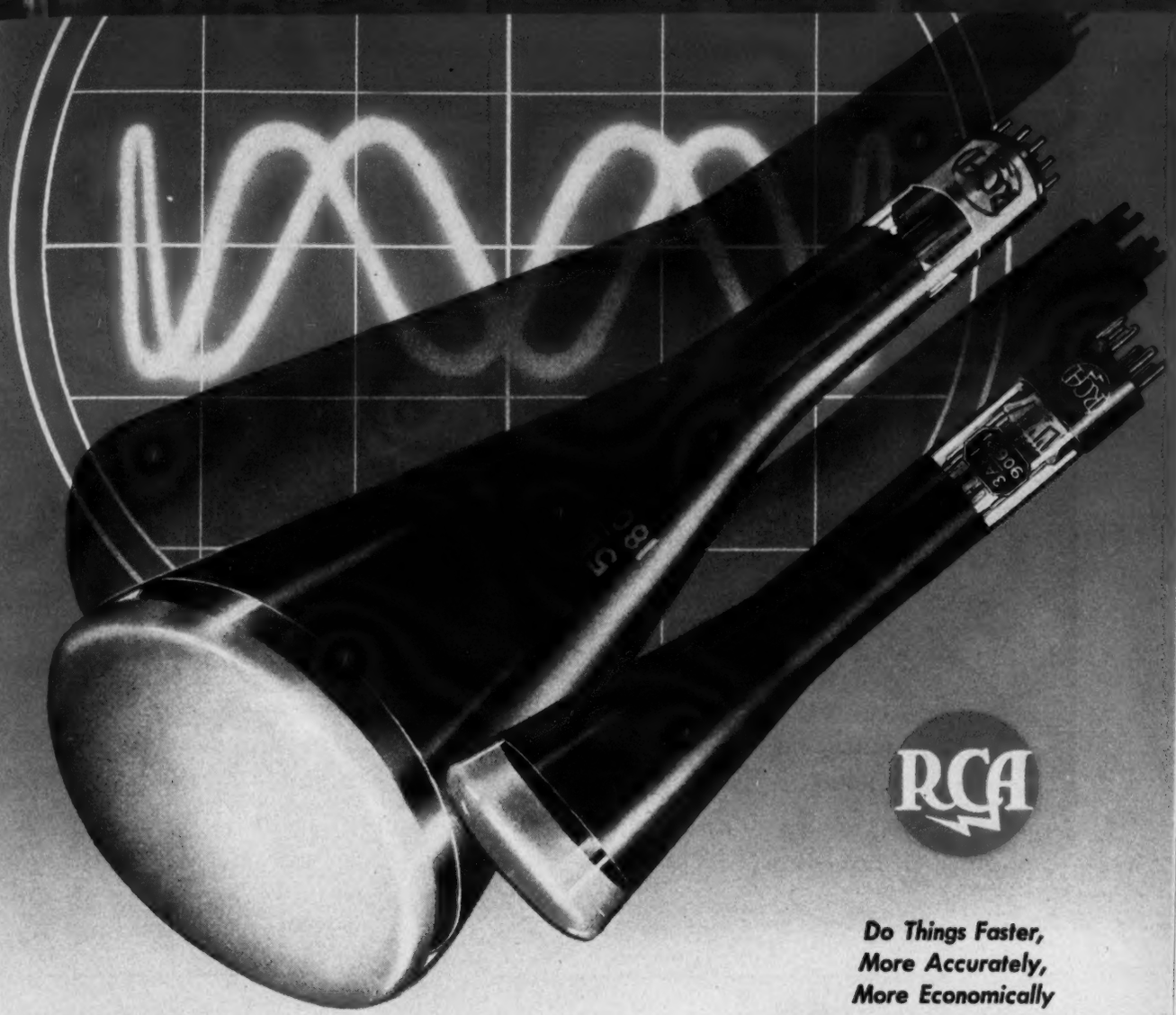
Kardex is now available in finely constructed, smart appearing wood cabinets designed for permanent use. Kardex employs no critical war materials, may be had without a priority rating.





FACT-POWER . . . . exclusive with Kardex, means vital facts are signalled for instant selection, assuring prompt and accurate administrative action.

REMINGTON RAND



Modern Measurements . .

without mechanical movement or its limitations

Perhaps no single type better illustrates the indispensable nature of the Electronic Vacuum Tube throughout science and industry than RCA Cathode-Ray Tubes.

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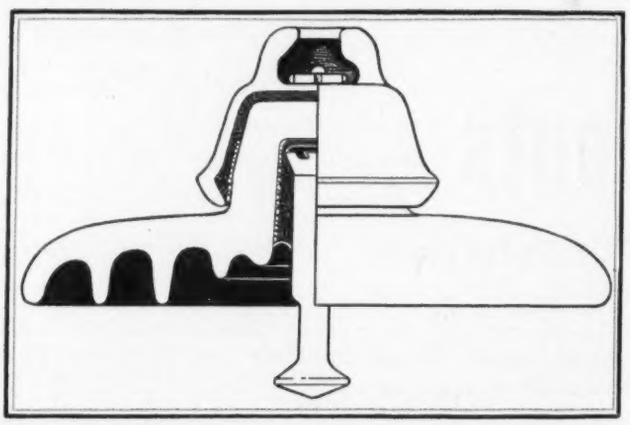

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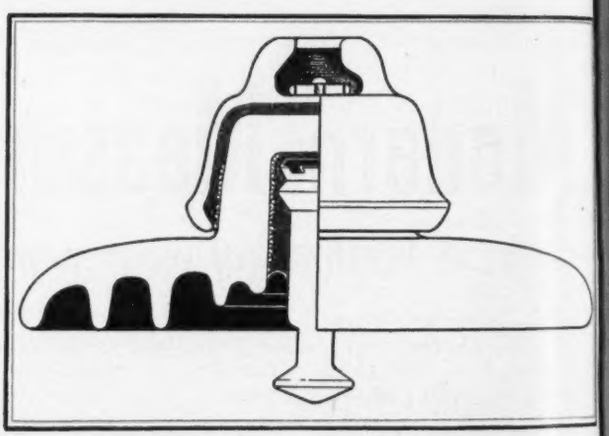

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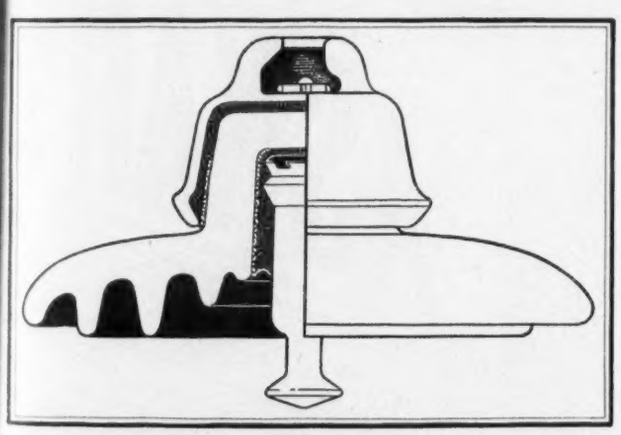

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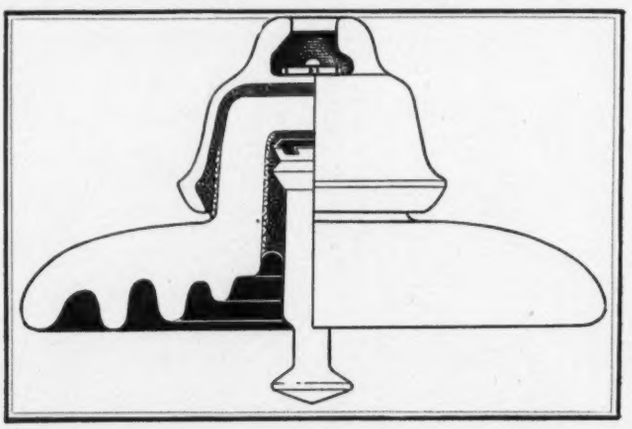

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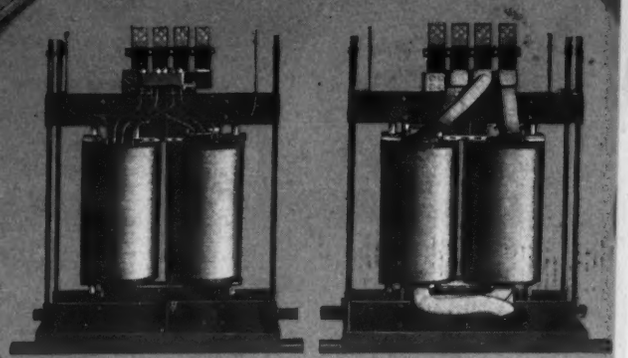

Core and coil structure, front and back view, of 400 KVA, Type MG, dry type, air cooled, natural draft, glass insulated transformer, 75 deg. C. rise, 60 cycle, single phase, 4160 V. primary, 120/240 V. secondary.

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Power Center Unit with panelboard door removed.

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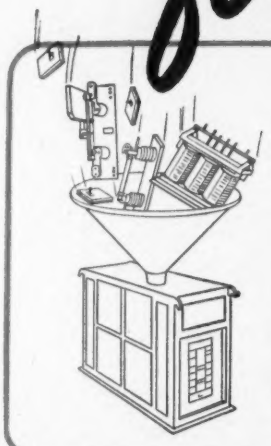

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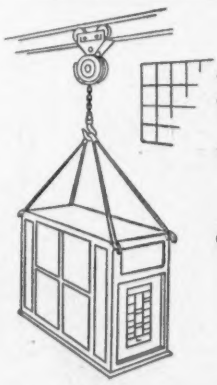

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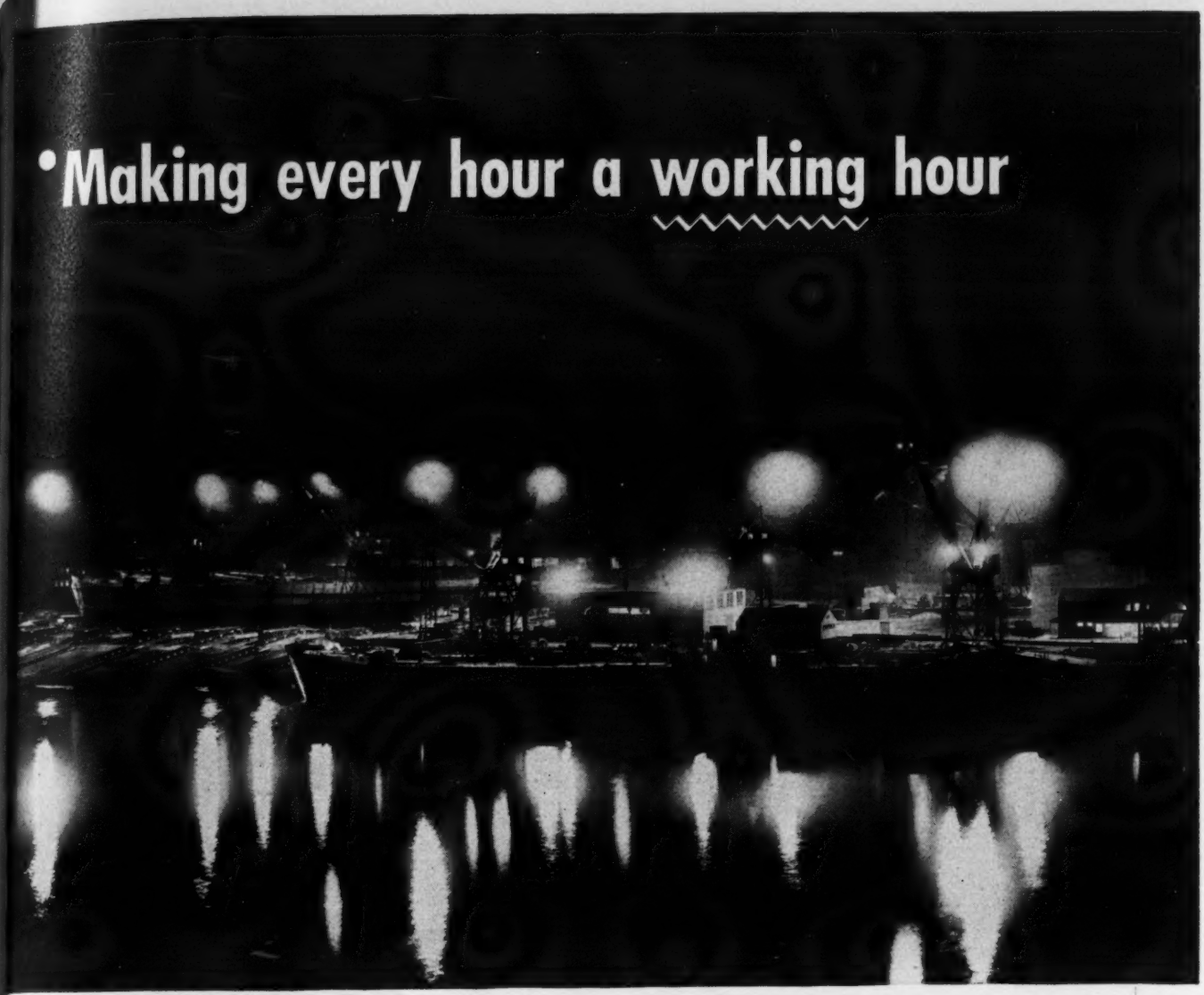

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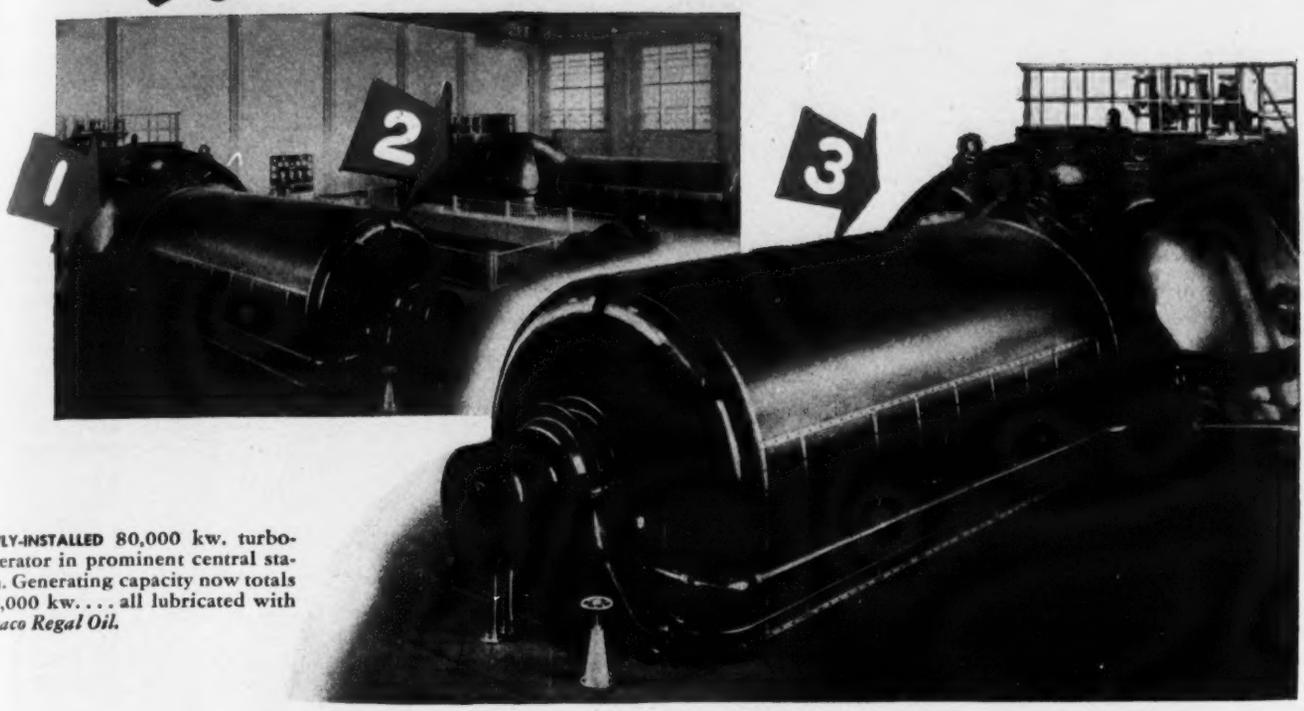

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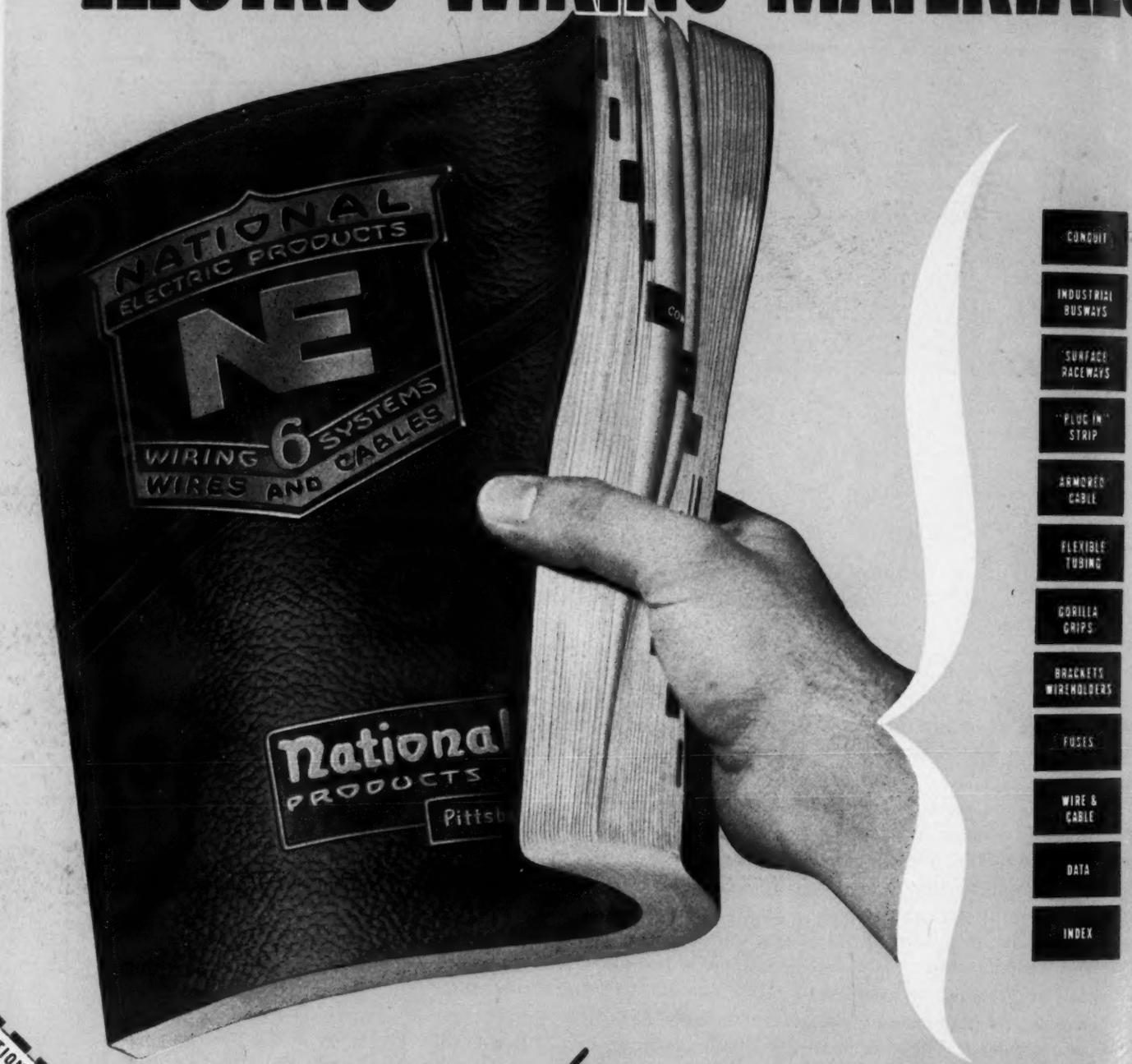

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Security of Employment

Many a utility executive who shuddered to think what the war was going to do to his personnel has realized that in spite of greatly reduced forces the operation, even with today's much more complicated problems, is getting along just fine. It is true that a number of operations, such as construction and selling, that dwindled down to virtually nothing accounted for a great many of those who left. Nevertheless, the fact remains that utility executives are finding out that they can do the job with less people than were formerly thought necessary.

In terms of post-war, what does that mean? It can mean but one thing, and that is, if utilities are to carry their former employment load they must find ways of expanding operations to take care of these extra people. Certainly the same or lower operations will not warrant a larger force.

Some of the reduced requirement for labor has resulted from change in method. Meters, for instance, are read at greater intervals and billings and collections are less frequent. How many companies will go back to the pre-war monthly practice? Other labor-saving economies can be expected after the war.

In many respects this reduced labor requirement will be more advantageous than the immediate saving. In the long run it will remove the security factor from a position of first importance in utility employment. As that disappears it will take with it the enervating practice of seniority in the white collar jobs and employees will have the same competitive spirit that permeates non-regulated businesses. Thus, both men and company will be better off than before.

Fifteen years or more ago security of employment might have been a good substitute for competitive wages, but with the new cradle-to-grave federal security plans employers will have to offer something better. If the new program is passed it will have everything that a security-seeking employee desires.

Employers who have placed great emphasis on security, therefore, are now facing the need for a new program. Instead of the advantages of security, new people will have to be offered the advantages of getting ahead, and to do this sincerely will mean the revamping of a great many employment practices.

Security of employment, besides having the obligation to carry employees, has a way of discouraging people from seeking employment elsewhere. The result is the creation of a force of long-term employees, with too few young people—people with new and fresh ideas, people on whom to build.

The glamour that once surrounded electric power has now been placed by youth on airplanes or electronics or some other new industry. They offer new and vast opportunities. Those alert and imaginative brains are needed in the utility business, but security of employment is too tame a lure when initiative is on the prowl. •

Outdoor Steam Plants Save Materials, Cut Costs

Typical economies of 75 percent in cubic contents and structural steel along with 50 percent in floor area—Details of 12 geographically diversified installations

LOUIS ELLIOTT, Consulting Mechanical Engineer, Ebasco Services, Inc., New York

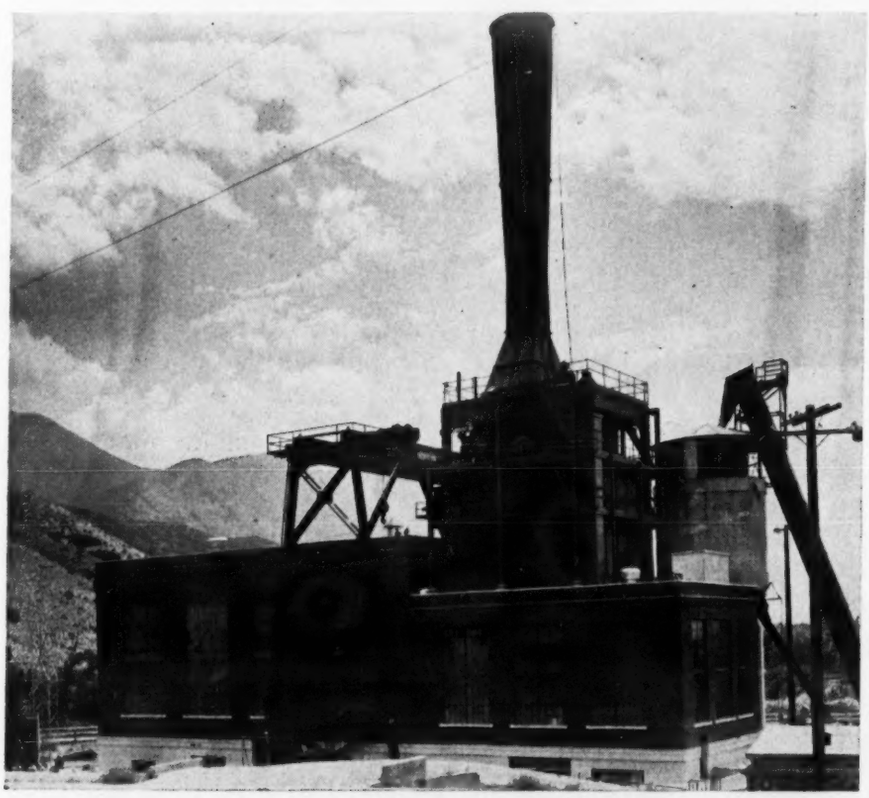

FIG. 1—An early design: silo-type bunker delivering coal to stoker hoppers by horizontal conveyor; firing aisle in low building at right; main building at left housing turbine, condenser, auxiliary equipment and electrical controls; gantry crane for handling turbo-generator parts and auxiliaries through roof hatches

UTILITY-COMPANY CLIENTS of the service company by which the writer is employed have during recent years authorized fifteen steam installations, in the United States and foreign countries, in which important equipment has been placed outdoors or partially housed. Capacity has totaled over 300,000 kw. Aggregate investment saving achieved by reduction in housing for equipment—as compared with provision of conventional fully housed plant—has been of the magnitude of a million dollars. This is in addition to the still greater economies that have been effected concurrently by simplification of equipment and its arrangement. Expense for maintenance of structures and for operating labor have been reduced by adopting the simpler type of plant, with no sacrifice in thermal economy.

Important under present conditions is reduction in time required for construction and—still more important—economy in use of critical materials such as structural steel. Savings in buildings and steel achieved by the most recent semi-outdoor design of steam plant, as compared with the older fully housed type, may be roughly as follows, for a single-unit, 30,000-kw. installation: 75 percent in cubic contents and 50 percent in floor area of building; 75 percent in structural steel and 50 percent in structural and reinforcing steel combined. If reinforced-concrete frame is used for the outdoor plant, as compared with structural steel for the fully housed, structural steel for the former amounts to only a few percent of that for the latter.

The semi-outdoor type of station is especially suited to construction with top of foundation slab at ground level—when soil conditions permit. This design minimizes excavation and substructure concrete, and correspondingly reduces building costs. Simplicity of foundations and absence of substructure are indicated in the accompanying illustrations.

Outdoor Trend

Reduced provision for housing, in design of steam stations, follows logically from long experience with outdoor transformers, circuit breakers

and other substation equipment, and from the several hundred plant-years of successful operation of semi-outdoor hydro-electric plants. In the latter, vertical-shaft umbrella-type generators are unhoused or lightly housed, served by a gantry crane.

Outdoor steam boilers have been used for a good many years at steel mills, oil refineries and other industrial plants. In a number of power plants built in the tropics boilers have been placed outdoors or protected by a roof only. During the past few years semi-outdoor boiler equipment has been utilized by utility companies (other than those of Electric Bond & Share group) in stations at Tucson, Ariz.; Alamosa, Col.; San Antonio, Tex.; Taunton, Mass., and elsewhere. In each of three installations recently made in the San Francisco region there are two 200,000-lb.-per-hour, 1,500-psi., 950-F. steam-generating units of the outdoor type, with upper portion and firing aisle protected.

As for turbines, General Electric Company installed at its Schenectady works, in 1932, a 20,000-kw. mercury-steam electric power station, including mercury and steam turbines and condenser-boiler; a recent description of the plant by G. E. engineers states that this "installation, with the exception of the control panels, firing aisles, pumps and pulverizers, is installed outside and has passed through several severe winters without any operating difficulties." Quite recently two municipal plants at Glendale and Burbank, Calif., have

FIG. 2—Station building gas-fired plant in Texas; at right, two outdoor steam generators with steel casing weather-proofed; housed firing aisle between boilers; air heaters and fans entirely outdoors; station building housing turbine and crane

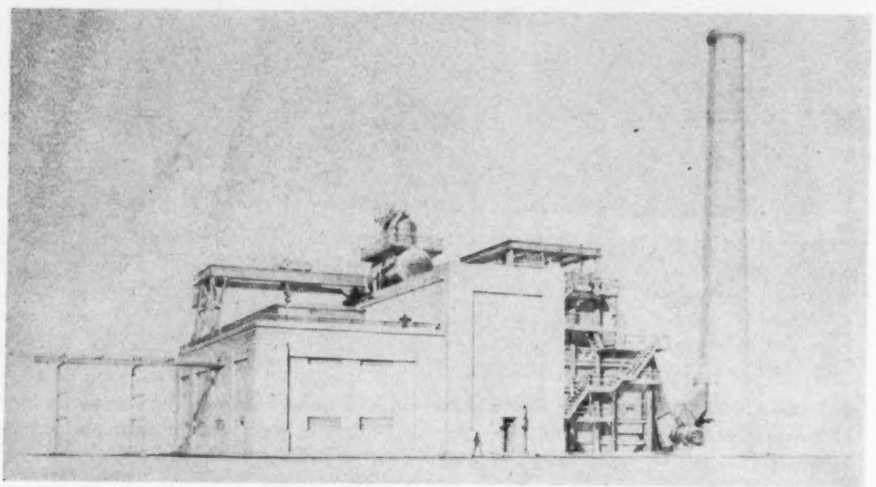

FIG. 3—Outdoor gas-fired steam generator and fans; auxiliary bay with deaerator on roof; turbine on open deck housed in small removable structure, served by overhead gantry; blackout building provided with forced ventilation.

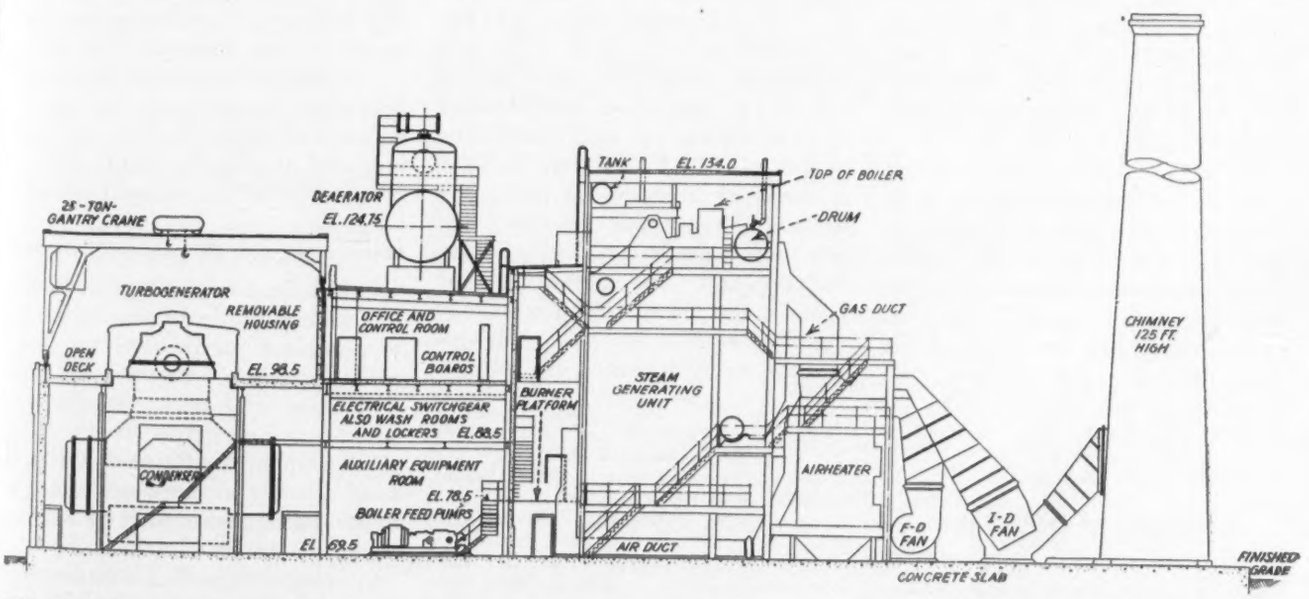

FIG. 4—Section of semi-outdoor station; turbine weather-protected, with gantry crane above; center, auxiliary building housing plant controls; at right, steam generator with operating space enclosed, outdoor draft fans on concrete slabs

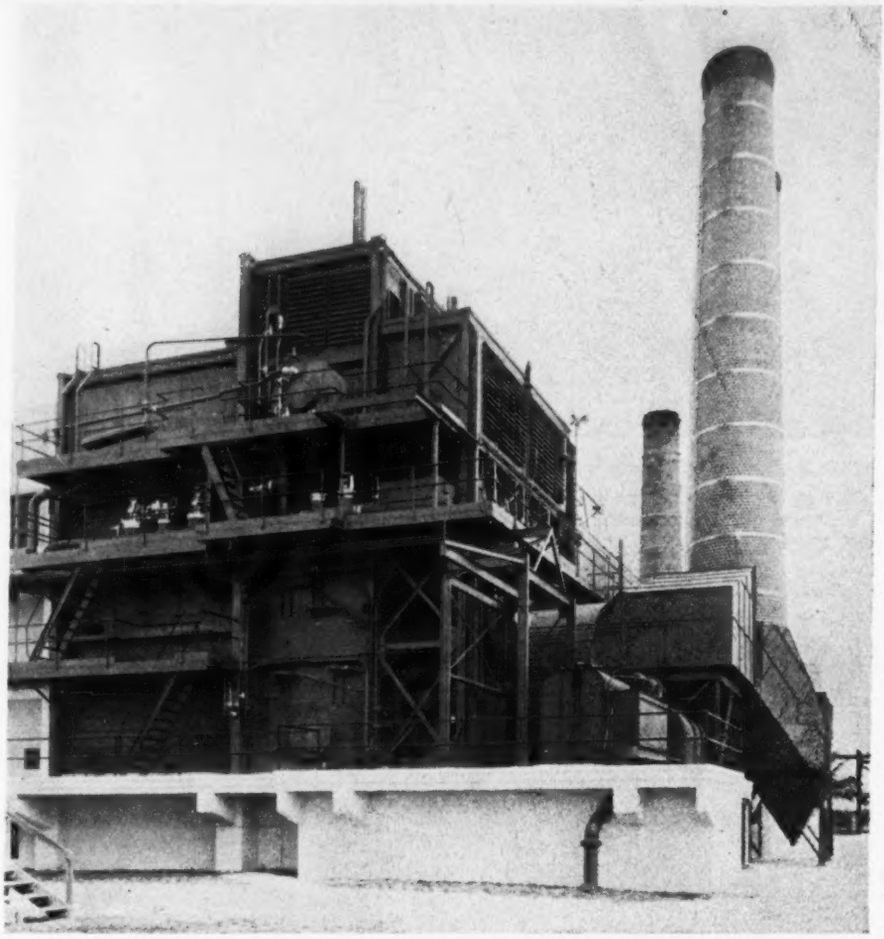

FIG. 5—A 300,000-lb.-per-hour steam generator with sides and rear in the open; front containing oil burners fitting into an opening framed in side wall of adjacent turbine building; a louvered "clerestory" provided over upper boiler drum

utilized semi-outdoor design both for boilers and for 10,000-kw. turbines, the latter served by gantry cranes; the Burbank installation was described in ELECTRICAL WORLD for July 25, 1942; in that article investment saving as compared with fully housed stations is said to approximate $6 per kilowatt.

An early proposal for outdoor steam design was presented by G. E. Goodale in ELECTRICAL WORLD for April 29, 1933, in an article entitled "Unit Generating Station Combines Reliability with Economy." The illustration shown at the head of the article shows a 1,000,000-kw. outdoor-type power station with five 200,000-kw. units. The conception was a bold one.

Semi-Outdoor Installations

Subjoined schedule gives general location, date of construction, class of steam conditions and summary of plant design features for each of twelve outdoor and semi-outdoor steam installations made during the past twelve years or under construction. As indicated, locations are in widely separated parts of the United States.

Installed capacities range up to 60,000 kw., individual turbine units up to 40,000 kw. and steam conditions to 850 psi., 900 F. The term "boiler" is employed in subjoined listing for brevity, although the units are properly "steam generators." All of them include draft fans, all but one air heaters, and most of them economizers. Two stations are fired with coal and the rest with natural gas and fuel oil:

Arizona—1929, 18,000 kw.; 450 psi., 750 F.; boiler room side walls omitted.

1940, boiler only; 450 psi., 750 F.; boiler outdoors, with roof slab above.

Utah—1936; 18,000 kw.; 450 psi., 750 F.; boiler outdoors, with roof slab above, induced-draft fan on slab, shelter for boiler operators, turbine in low building with roof hatches, and gantry crane straddling turbine room.

Nebraska—1938, two 200,000-lb. per-hour boilers primarily for industrial steam supply, with 6,000-kw. back-pressure turbine; 450 psi., 750 F.; boilers semi-outdoor, with roof above units and firing aisle housed.

Kansas—1938, 23,000 kw.; 650 psi., 825 F.; two boilers semi-outdoor, with roof above units and firing aisle housed.

Texas—1938, 31,250 kw.; 650 psi., 825 F.; two boilers outdoors (no roof above units), with firing aisle housed.

1938, 25,000 kw.; 850 psi., 900 F.; boiler outdoors, with hood above unit and firing aisle housed.

1943, 35,000 kw.; 850 psi., 900 F.; boiler outdoors, with roof slab above unit and firing aisle housed, turbine on open deck protected by light removable housing and served by gantry crane.

Florida—1942, 30,000 kw.; 850 psi., 900 F.; boiler outdoors, with hood above unit and firing aisle housed.

Carolina—1942, 60,000 kw.; 850 psi., 900 F.; two boilers semi-outdoor, with hood above, and with inclosed aisle between units for pulverizing plant and controls and to shelter boiler operators.

Arkansas—1943, 30,000 kw.; 650 psi., 825 F.; boiler outdoors, with roof slab above unit and firing aisle housed.

Louisiana—1943, 35,000 kw.; 850 psi., 900 F.; boiler outdoors, with roof slab above unit and firing aisle housed, and turbine on open deck protected by light removable housing, served by existing crane on extension runway.

One of the earlier designs of semi-outdoor utility steam stations is that briefly described under heading Utah, in above schedule. (Fig. 1).

The first installation listed under heading Texas in foregoing schedule is illustrated in Fig. 2, which shows the temporary end.

Fig. 3 reproduces an architect's sketch of a single-unit steam plant now under construction. Condenser "basement," below turbine, might readily have been made of the open type, with massive columns and omitting wall panels; inclosure was preferred in this instance (Fig. 4).

Accessibility obtainable for normal operating functions and for maintenance, with outdoor boilers, is clearly indicated in Fig. 5, which shows a unit of 300,000 lb. per hour capacity.

Investment and Operating Economies

It is difficult to give specific figures for saving in investment costs for semi-outdoor stations, as compared with the older conventional type. Utilization of outdoor features and accompanying reduction in structures, combined with general simplification of equipment and arrangement—such as provision of but one boiler per turbine, of one circulator for a condenser, and of a minimum of spare equipment, have resulted in marked decrease of unit cost.

Investment costs per kilowatt, of plants designed for a large group of power companies, have by these means been reduced by more than 25 percent during the past ten or fifteen years; aggregate saving has amounted to many millions of dollars. As to the saving resulting from semi-outdoor design by itself, considered apart from economies effected by other design improvements, the former will usually amount to several dollars per kilowatt of capacity installed; the magnitude of the reduction, of course, depends upon how much equipment is installed outdoors or semi-housed.

No particular difficulties in operation and maintenance have been experienced with these outdoor installations, even though station locations have been such as to give a wide variety of climatic conditions, from semi-tropical to temperate—in a number of cases involving freezing weather. While maintenance and certain operating activities may involve discomfort during inclement weather, this has not proved an important objection. In general, the simplified design, with a minimum of structures and with its greater compactness, minimizes operating personnel and reduces operating and maintenance costs, as compared with conventional fully housed plant.

Summary

Considering the proved economies in time required for construction, in investment and in consumption of material, particularly important at the present time, and the record of successful operation in various climates over a period of years, engineers and executives should give thorough consideration to the utilization of outdoor and semi-outdoor steam-plant construction.

A barrier of conservatism of course exists, which will continue to retard the adoption of semi-outdoor steam stations, in spite of the substantial savings effected in comparison with fully housed types. Adoption of this "radical" type of plant encounters the skepticism of engineers accustomed to the use of large high-cost structures for housing steam equipment, but it is believed that monumental structures of this kind, representing one phase in steam station development, will gradually give way to the new economies.

Resistance Study on a Conduit-Return System

Resistance measurements after seven years on the conduit-return wiring system at the University of Wisconsin bear out early expectations

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THE conduit-return system of branch circuit wiring is a system of rigid steel conduit wiring in which the branch circuit conduits containing the live wires of the branches constitute the ground or neutral (return) conductor of the branches. Features of this system together with the results of laboratory test measurements of the resistances and impedances that were encountered were presented‡ in 1929.

First installation of the system was made in the 110 branch lighting circuits of the mechanical engineering building at the University of Wisconsin when this building was erected in 1931.

This article reports the results of measurements made to determine the resistances of the steel conduit-returns of all the branch circuits in this building after seven years of service. These measurements give no evidence of the development of high-resistance contacts or joints in this conduit-return installation during the first seven years of its life.

Further, these a.c. resistance measurements conform with estimates based on earlier determinations of conduit resistance. They justify the conclusion that parallel paths to ground, external to the conduit and resulting from contacts of conduit

*Professor of Electrical Engineering. †Engineer.

‡Edward Bennett, "The Conduit-Return System of Branch Circuit Wiring." Reprint No. 14, Engineering Experiment Station, University of Wisconsin. Edward Bennett, "Economy in Using Conduit as Return Conductor," "Electrical World," Vol. 94, page 461, September 7, 1929, and "Relative Hazards of the Conduit-Return Wiring System," page 527, September 14, 1929.

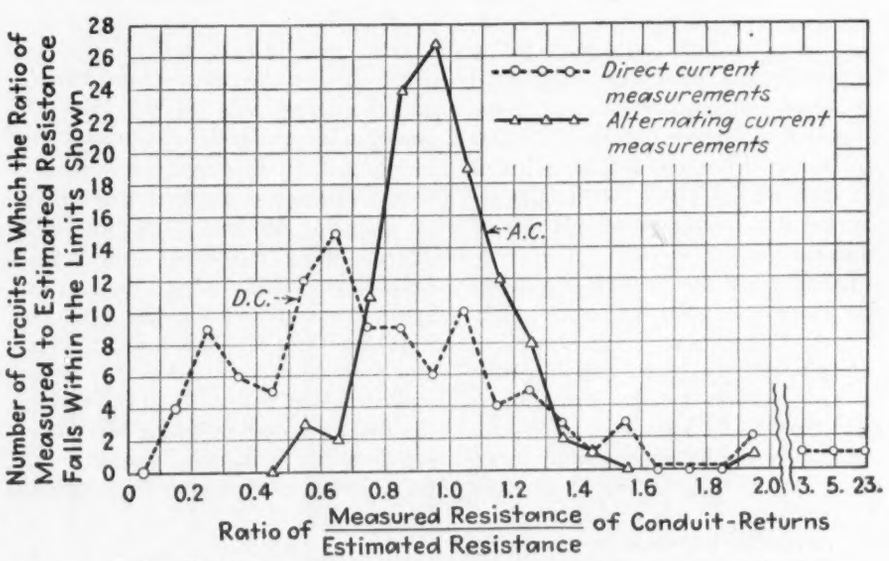

Number of Circuits in Which the Ratio of Measured to Estimated Resistance Falls Within the Limits Shown
Direct current measurements
Alternating current measurements
A.C.
D.C.
0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0 3. 5. 23.
Ratio of Measured Resistance / Estimated Resistance of Conduit-Returns

FIG. 1—Close correlation of estimated to measured resistance of conduit return for a.c. circuit shows that parallel paths to ground, external to conduit, have little effect on resistance of conduit return

with grounded building steel, have little effect on the a.c. resistance of the conduit return.

Measurements

In all branch lighting circuits in this building the live side of the circuit is a No. 12 rubber-covered copper wire. The ground side is the steel conduit which carries the live wire. The conduit is standard ½ in., with standard threaded couplings. All conduit switch and outlet boxes are sherardized.

The only respect in which this conduit-return installation differs from the customary rigid conduit constructions is in the use of copper wire bonding links to insure permanent low-resistance connections between all conduits entering any outlet or switch box.

Two sets of measurements were made to determine the resistances of the conduit-returns from the most remote outlet box on each branch circuit to the permanently grounded metal box inclosing the distributing panel at which the branch circuit originated. To make these measurements on any branch circuit the circuit was disconnected, all lamps on it were unscrewed and the copper conductor wire connected to the outlet box by a jumper of negligible resistance at the most remote outlet box.

D. C. Measurements

First set of measurements of the resistance of the conduit-returns was made with direct current from a 3-volt dry cell. The results of these measurements are spotted on Fig. 1, the points being connected by a dashed broken line. The results are expressed by using the ratio of the measured resistance between the most remote outlet box on each branch and the distributing panel box to the estimated d.c. resistance of this run of conduit.

Location of the conduit buried in the floors and walls was not exactly known. Consequently the length of conduit from the most remote outlet in any branch to the distributing panel had to be estimated by assuming the probable location and measuring the distances. The "estimated d.c. resistance" was computed from this estimated length, using as the resistance of conduit per foot the value given in Fig. 2. These values of resistance were taken from the references given in the footnote and are based upon careful direct- and alternating-current measurements made upon 100-ft. runs of conduit.

It will be observed from the ratio chart (Fig. 1) that in many of the circuits the measured resistance is much lower than the estimated resistance. This seems to indicate that branch circuit conduits make metallic contact at numerous points with the grounded steel framework of the building establishing numerous parallel paths between the last outlet box and the distributing panel, rather than the single conduit return on which the "estimated d.c. resistance" is based. This explanation is substantiated by the a.c. measurements to be described.

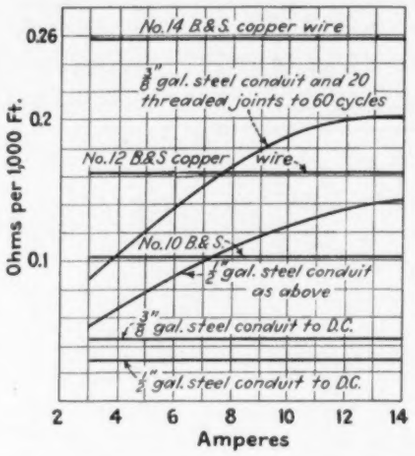


FIG. 2—Effective resistance of 100-ft. lengths of different grounded conductors at 25 deg. C.

Only one circuit was found in which the d.c. resistance of the return path exceeded that of the No. 12 copper wire which the conduit-return supplanted. In this case the conduit-return resistance was four times that of the No. 12 live wire. In this circuit the resistance was variable. Upon examining the outlet boxes it was found that the locknuts were not tight and the bonding link had been omitted in one of the intermediate outlet boxes. Upon tightening the locknuts and inserting the missing bonding link, the resistance of this circuit dropped to the normal low value.

A.C. Measurements

Effective a.c. resistance of the conduit-returns was computed from watt-meter measurements of the total loss which occurred when 60-cycle a.c. was passed through the live wire within the conduit across the jumper at the last outlet box and then back by way of the conduit.

From the estimated length of the live wire, the I^2R loss in the wire itself was computed and this value subtracted from the measured total loss, and then with the known value of the current the effective resistance of the conduit-return to 60-cycle a.c. was computed.

Results of these measurements and computations are also plotted (Fig. 1) on the ratio of the measured resistance to the estimated a.c. resistance of the run of conduit. The estimated a.c. resistance was computed from the estimated length of the conduit run and the a.c. resistance per foot of ½-in. conduit taken from the curve (Fig. 2) for ½-in. conduit.

It will be seen (Fig. 1) that in only one branch out of the 110 does the measured a.c. resistance differ from the estimated resistance by more than 50 percent.

If estimated lengths were more accurately known, the ratios of measured resistances to estimated resistances for a.c. would be found to differ much less from unity.

Conclusions

Distribution of the ratios for a.c. is in striking contrast to the distribution for d.c. measurements. Measured d.c. resistances of the return paths from the far ends of the branches to the grounded panel boards are far less than the estimated resistances. This is because the conduit is in contact with the grounded steel structural members of the building at many points, and the return direct current divides among these parallel paths in proportion to their conductances.

In the case of the alternating current however, the greater reactance of these return loops external to the conduit limits the current that may return by them and confines the return current largely to the conduit surrounding the outgoing live conductor. Within the metal of the steel conduit, the current density is a maximum at the inside surface and decreases rapidly from the inside surface to the external surface of the conduit. Therefore, external parallel paths, even of very low ohmic resistance, shunt very little current from the conduit.

Lightning Protection Survey of Distribution Transformers

Pennsylvania Electric Association analysis covers 185,000 transformers totalling 2,375,000 kva. — One annual failure among 200 units, approximately — Types of protection compared — Fuse blowings and arrester failures embraced

AMONG 184,123 distribution transformers totaling some 2,375,000 kva. the over-all lightning failure rate per 100 in 1941 was 0.59. Similarly the rate of fuse blowings was 4.79 per 100 and the lightning arrester failure rate 0.28 per 100 transformers. These data (Table I) are high spots in an analysis by W. H. Jones of comprehensive reports from 18 utilities which are members of the Pennsylvania Electric Association.

His report, discussed at the recent meeting of the association's transmission and distribution committee in Harrisburg, was the vehicle for the assertion that "a practical interpretation of data so far obtained would indicate one expected lightning failure per year for every 200 transformers in service with either built-in or interconnected external protection." Caution is expressed with regard to too broad an application of this value because of the wide variety of distribution systems and areas (from 60 to 9,000 square miles), the range in numbers of transformers on each system (300 to 50,000), as well as the fact that sparsely populated rural districts are embraced along with major urban concentrations.

Transformer Failures

The over-all rate of transformer failure (0.59 per 100) in 1941 is the lowest rate calculated in the nine years that the survey has been conducted, being 23 percent lower than 1940, 17 percent below 1939 and more than 50 percent below the 1937 rate (Table I). Reasons assigned for the bettered performance were:

1. General decrease in intensity and frequency of electrical storms. (All companies with increased failure rates reported more severe storm seasons in their areas.)

2. Increased resort to interconnection.

		TOTAL			WITH EXTERNAL LIGHTNING PROTECTION			WITHOUT LIGHTNING PROTECTION	SELF PROTECTED	COMPLETE INTERNAL PROTECTION
		1941	1940	1939	INTER CONNECTED	NONINTER CONNECTED	TOTAL			
TRANSFORMERS IN SERVICE	5 KVA. & UNDER	104516	98057	87812						
	7½ – 15	47060	47071	43751	FIGURES BELOW SHOW SIZES OF GROUPS FOR WHICH COMPLETE DATA WAS SUBMITTED					
	20 KVA & OVER	32547	32457	29590						
	TOTAL	184123	177585	161153	38772	28390	67162	4173	7855	10819
TRANSFORMER FAILURES		1082	1368	1148	243	188	431 *	54	27	45
FAILURES PER 100 TRANSFORMERS		0.59	0.77	0.71	0.63	0.66	0.64	1.29	0.34	0.42
FUSE BLOWINGS PER 100		4.79	4.24	4.23	5.72	9.70	7.45	1.32	0.59	0.42*

* SECONDARY BREAKER TRIPPING RATE.

TABLE I—Summary of transformer data

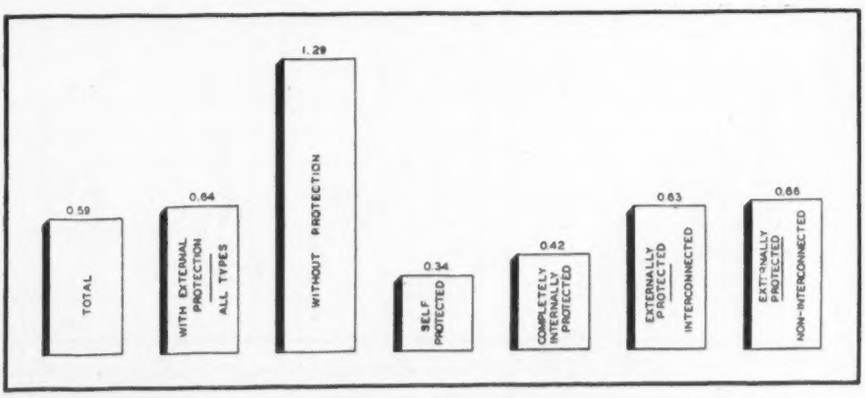


FIG. 1—Failure rate per 100 transformers for various types of transformers and connections

COMPANY	GENERAL DATA: DISTRIBUTION CHARACTERISTICS: 100 CIRCUIT MILES	100 WIRE MILES	AREA SERVED – SQUARE MILES	LINE VOLTAGES IN KV.	CONNECTION TYPE	MINIMUM FUSE SIZE	KVA. SIZE GROUPING	TRANSFORMERS IN SERVICE: TOTAL SINGLE PHASE UNITS	AVERAGE KVA. PER TRANSF.	WITH EXTERNAL LIGHTNING PROTECTION	WITH EXTERNAL LIGHTNING ARR. & INTERCONNECTED NEUTRAL	WITHOUT LIGHTNING PROTECT'N	SELF PROTECTED	COMPLETELY INTERNALLY PROTECTED	TRANSFORMER FAILURES: TOTAL No. OF FAILURES	TOTAL RATE PER 100 TRANSF.	TOTAL No. OF WINDING FAILURES	WINDING FAILURES PER 100 TRANSFORMERS: TOTAL	WITH EXTERNAL LIGHTNING PROTECTION	WITH EXTERNAL L.A. & INTERCONNECTED NEUTRAL	WITHOUT LIGHTNING PROTECT'N	SELF PROTECTED	COMPLETELY INTERNALLY PROTECTED	TOTAL No. OF BUSHING & LEAD FAILURES	BUSHING & LEAD FAILURES PER 100 TRANSF.: TOTAL	WITH EXTERNAL LIGHTNING PROTECTION	WITH EXTERNAL L.A. & INTERCONNECTED NEUTRAL	WITHOUT LIGHTNING PROTECT'N	SECONDARY BREAKER FAILURES PER 100 TRANSFORMERS	FUSE BLOWINGS: TOTAL No. OF BLOWINGS	RATE PER 100 TRANSFORMERS: TOTAL	WITH EXTERNAL LIGHTNING PROTECTION	WITH EXTERNAL L.A. & INTERCONNECTED NEUTRAL	WITHOUT LIGHTNING PROTECT'N	SELF PROTECTED	FUSE BOX FAILURES: TOTAL No. OF FAILURES	RATE PER 100 TRANSFORMERS: TOTAL	WITH EXTERNAL LIGHTNING PROTECTION	WITH EXTERNAL L.A. & INTERCONNECTED NEUTRAL	WITHOUT LIGHTNING PROTECTN	SELF PROTECTED	LIGHTNING ARRESTER FAILURES: TOTAL No. OF FAILURES	RATE PER 100 TRANSFORMERS: TOTAL	WITH EXTERNAL LIGHTNING PROTECTION	WITH EXTERNAL L.A. & INTERCONNECTED NEUTRAL	SELF PROTECTED	COMPLETELY INTERNALLY PROTECTED	COMPANY
1	129.0	300.0	9000	4.0 4.6 6.6	⟨ Δ Δ	5A	C 1644	A 191.47	8.9	28892	20232				2384	170	0.59	145	0.50	0.51						21	0.07	0.08					0.08																			0.007	1
2	30.0		817	2.3 4.0	Δ Y	7A	B 7338 C 1335	A 73719 B 71189 C	48.4	21130	8864				776	134	0.81	4.4	0.30	0.21	0.19					0.0	90	0.41	0.43	0.40			0.0	570	2.40	270	306			18	0.08	0.09	0.14										52	0.24	0.25	0.40			2
3	120.0	380.0	9000	2.3 4.0 4.6 6.6	Δ Δ Y Δ Δ	1A	A 30000 B 11000 C 6500	A 10316 B 8.2 45743 C 2160		32293				13	744	275	0.56	233	0.49	0.49					0.0	54	41	0.09	0.09				0.0																			177	0.37	0.38				3
4	45.7	112.2	2893	2.3 4.0 6.6	Δ Δ Δ	5A	B 2807 C 2160	A 10316 B 2.3 C 2160	11.4	14903	7944	2.3	736	41	87	0.37	7.1	0.46	0.46	0.59	4.35	0.40	0.0	10	0.07	0.07	0.08	0.0	0.0	1270	8.29	8.47	1.15	39.2	43.8	69	0.30	0.31	0.40	4.35	1.77	4.4	0.20	0.30	0.44	0.48	0.0	4
5	8.2		417	4.0	Y	10A	A 1775 B 21.45 C 1087		12.5	4999	4999			1	10	12	0.24	1.0	0.20	0.80	0.20					0.0	2	0.04	0.04	0.04				0.0	97	1.94	1.93	1.93			2	0.04	0.04	0.04										21	0.42	0.42	0.42	0.0	0.0	5
6							A B C																																														6
7	13.2	35.6	5000	2.4 4.6 6.6 11.0	⟨ Δ Δ Δ	1A	A 2831 B 1399 C 873		14.0	4873	3308			30		29	0.59	2.8	0.51	0.51	0.48					0.0	4	0.08	0.08	0.12				1.89																								7
8	4.0	10.0	147	2.3	Δ	5A KVA	A 1021 B 435 C 398		18.0	1045				63	766	7	0.38	7	0.38	0.48					0.28	0	0.0	0.0	0.0				0.0	105	5.69	10.1			7	0.67	0.67																	8
9	10.3	24.3	414	2.3	Δ	15 OR 20KVA	A 1980 B 930 C 334		33.3	329				225		8	0.23	7	0.20	0.19							0.44	1	0.03	0.03				0.0	409	11.9	12.7			9	0.26	0.26																	9
10	11.1	30.2	128	2.3 4.0	L Y	50A	A 1428 B 444 C 6205		33.4	6193	1829	48	7	51	0.63	29	0.36	0.38	0.38	0.38	0.0					0.0	22	0.27	0.28	0.28	0.33	0.0	40	0.50	0.53	0.53	0.38	0.0	7	0.09	0.09	0.11	0.0																	10
10-A	58.0	102.0	1418	2.3 2.3 4.0	L Δ Y	15A	A 10242 B 7226 C 3201		11.4					1526	384	91	0.44	60	0.29							0.13	0.05	31	0.15				0.0	387	1.78				14	0.07																			10-A
11	34.8	77.1	1390	2.4 4.0 6.6 13.8	Δ Δ Δ	1A	A 5535 B 1882 C 691		8.8	4731	888			498	1898	110	0.98	93	0.85	1.58	3.49					0.28	6	0.05	0.13	0.23				0.41	529	47.8	49.4	78.8		53.3	103	0.93	1.86	3.15										40	0.53	0.84	2.38	0.04	0.0	11
12	2.9	6.9	345	2.3 4.0	Δ Δ	5A	A 886 B 450 C 311		24.4	1417	131			41	119	10	0.83	6	0.38	0.42	1.93					0.0	3	0.19	0.21	0.0				0.84	1.78	11.3	12.2	28.2		14.8	6	0.35	0.42	0.78										0.0	0	0.0	0.0	0.0	0.0	12
13	4.0	9.2	316	2.3 4.0 4.6	⟨ Δ Δ	5A	A 1210 B 488 C 488		12.8	1827	1527			500	35	8	0.39	5	0.24	0.33	0.33					0.0	3	0.15	0.20	0.20				0.0	109	5.30	5.30	5.30		5.80	17	0.83	0.92	0.92										7	0.34	0.44	0.48	0.0	0.0	13
14–15	23.0	51.1	4853	2.3 4.0 6.6 11.0	⟨ Δ Δ Δ	5A	A 4538 B 780 C 309		5.7	3420	1981	2198	3	61	1.08																																									14–15
16	2.7	8.4	85	4.0 Y	Δ	5A	A 715 B 231 C 30		5.4	787	387	123	3	63		2	0.20	2	0.20	0.13	0.26	0.81	0.0	0.0	0.0	0.0	0.0	0.0	0.0					6.35	8.81	7.50	8.13	0.0	1	0.10	0.13	0.0	0.0	0.0										1	0.10	0.13	0.26	0.0	0.0	16
17	7.5	21.4	1020			10A	A 1689 B 250 C 93		5.5	2013	2013			199		8	0.41																																								17
18							A B C																																																18
19	2.8	6.3	219	4.0 7.2	Y Δ	5A	A 902 B 105 C 25		4.4	394	358			256	382	5	0.48	3	0.29	0.23	0.28					0.38	2	0.19	0.23	0.28				0.0	58	5.42	11.2	12.3		4.69	2	0.19	0.51	0.56										0	0.0	0.0	0.0	0.0	0.0	19
20	2.0	2.5	118	11.5	Δ	1½A	A 748 B 187 C 38		3.0	850				29	10	1.02	10	1.02	1.18															0.0	57	5.82	6.71			3	0.31	0.35												2	0.20	0.24				20
21	1.5	2.3	61	2.3 6.9	Δ Δ	15A	A 211 B 65 C 44		100	199				42	79	3	0.94	3	0.94	1.50	1.50					0.0	0	0.0	0.0	0.0				0.0	37	11.6	18.1	18.1		11.9	9	2.82	4.0	4.0										3	0.94	1.50	1.50			21
TOTAL	SEE TABLE I																																8824	4.79					254	0.27												458	0.28					TOTAL

TABLE II—Failure rates and fuse blowings correlated with system data (size groupings: A, 5 kva. and under; B, 7½ to 15 kva.; C, 20 kva. and over)

3. Construction changes (*e.g.*, substitution of line-type for bushing-type arresters; change of arrester-fuse sequence).

4. Installation of arresters on hitherto unprotected transformers.

5. Improvement of grounding systems.

Protection Factors

Relation between the 1941 failure rates for various types of transformers and connections substantiates the conclusion reached on the basis of the preceding eight annual reports, as follows:

1. Transformers with built-in protection, complete or partial, have the lowest lightning failure rate.

2. External protection, interconnected with neutral, is nearly as effective as built-in protection.

Interconnected transformers seem to show a fairly constant failure rate from year to year. Individual system rates for this group vary least from the average. In the area covered by this report there are now more transformers in this category than in any other. These facts indicate that the failure rate, as calculated, is now a fairly reliable indication of the performance of this type of lightning protection.

Unprotected transformers again show a high failure rate. This is in line with all previous years' experience, except last year, when the rate was unusually low. Ninety-seven percent of all unprotected transformers reported are on the lines of two companies. Last year the over-all failure rates for both these companies showed marked decreases. This year the same companies showed increases, both reporting severe storm seasons. These facts would indicate that the failure rate for unprotected transformers will vary considerably, depending on local conditions in the two areas mentioned.

The unprotected transformers on the lines of at least one company are mostly in shielded areas, where it has not been considered economic to install protection.

Comparative Protection

Self-protected transformers, for the second consecutive year, show a lower failure rate than the completely internally protected type. However, both rates are very low and nearly equal. Both types have a lower failure rate than last year. The number of self-protected transformers reported in service has decreased slightly. The number of completely internally protected transformers shows a 30 percent increase.

Winding failures out-numbered bushing and lead failures by 3 to 1. Individual companies showed wide variations from this ratio. One company, the same one as last year, had a preponderance of bushing and lead failures.

Fuses and Fuse Boxes

Over-all rate of fuse blowings caused by lightning is 4.79 per 100 transformers, a 14 percent increase over 1940.

Relation between fuse-blowing rates for various types of transformers or connections is roughly similar to that of last year, although the actual figures vary considerably. Externally protected transformers without interconnection have the highest rate and self-protected transformers the lowest. The comparatively low rate for unprotected transformers is probably due to the fact that a large percentage of this type are on a system with a 50-amp. minimum fuse size. This company, as would be expected, has by far the lowest fuse-blowing rate reported.

Comparison of fuse-blowing rates with transformer failure rates, by companies, fails to establish any definite relationship. This is to be expected, since fusing practices vary widely.

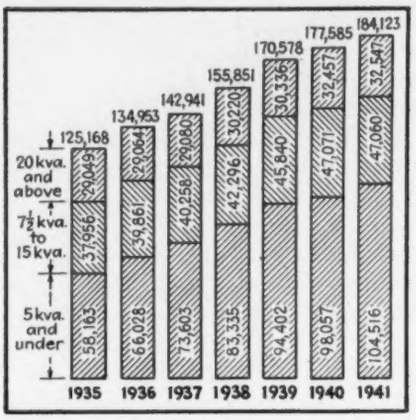


FIG. 2—Transformers in service by kva.-size groups

Minimum fuse size used by the reporting companies varies from 1 to 50 amp., with the smaller sizes up to 5 amp. predominating.

Rate of secondary breaker trippings on completely internally protected transformers was 0.47 per 100 transformers, slightly less than the 1940 rate.

Over-all fuse box failure rates decreased from 0.32 per 100 transformers in 1940 to 0.27 in 1941.

Lightning Arresters

Over-all lightning arrester failure rate for 1941 was 0.28 per 100 transformers. The 1940 rate was 0.44.

Lightning arresters and fuse boxes usually show approximately the same failure rates, indicating that light-

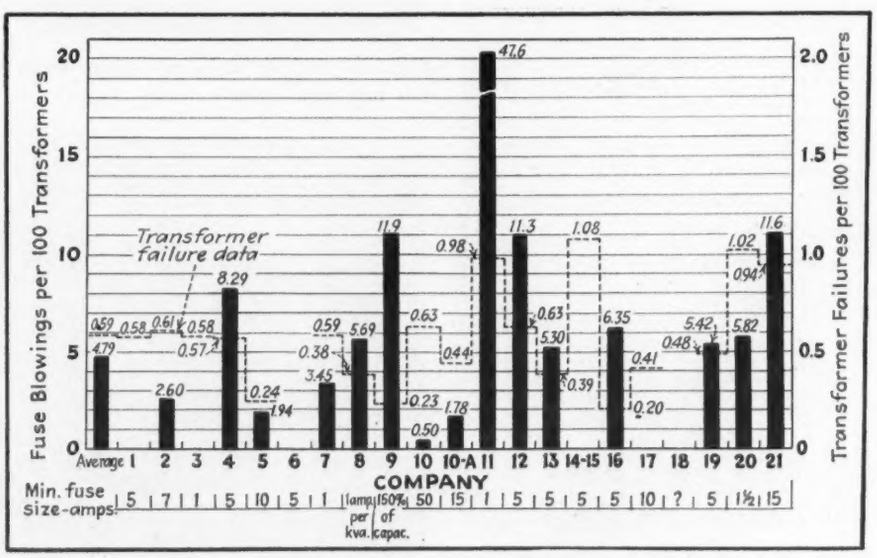

Fuse Blowings per 100 Transformers
Transformer Failure Data
Transformer Failures per 100 Transformers
Average 1 2 3 4 5 6 7 8 9 10 10-A 11 12 13 14-15 16 17 18 19 20 21
COMPANY
Min. fuse size-amps: 5 7 1 5 10 5 1 1 amp per kva. 150% of capac. 50 15 1 5 5 5 5 10 ? 5 1½ 15

FIG. 3—Comparison of fuse-blowing rate with transformer failure rate and minimum size fuse used

ning damage to one usually affects the other, regardless of their electrical location; *i.e.*, with arrester on line side of fuse, or *vice versa.*

A majority of the companies covered by this report locate the arrester on the line side of the fuse. This is consistent with the predominating fusing practice, since it was found by many companies using the smaller fuse sizes that excessive fuse blowings resulted from the functioning of arresters installed on the load side. Some companies using larger size transformer fuses place the arrester on the load side in order to protect against line outages caused by arrester breakdown.

Definitions

Transformer failure is one which results in the loss of service to a customer or group of customers, during or within 48 hours after a storm, or any transformer failure subsequent to a storm, the cause of failure being directly attributed to lightning. Where both the winding and leads are damaged in a transformer, the failure is reported only once, under "Winding Failures."

Functioning of fuses or destruction of fuse boxes, either of which results in loss of service, are not classified as transformer failures. Combination fuse and fuse box failures are reported only once, under "Fuse Box Failures."

Transformers provided with external lightning protection are those in which the protective equipment is a separate and independent piece of protective apparatus mounted externally to the transformer and between the high-voltage circuit and high-voltage bushings of the transformer.

Transformers without lightning protection are those for which no provisions have been made, other than the inherent characteristics of the transformers, to protect them from lightning failure.

Self-protected transformers are those in which the protective equipment is contained within or constructed as an integral part of the transformer unit.

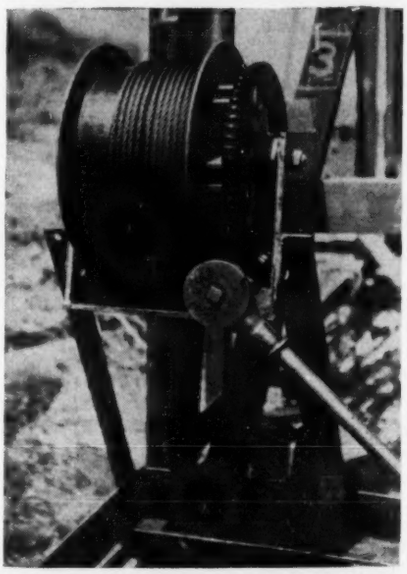
Complete internally protected transformers are those equipped with protective device, sectionalizing equipment and secondary breaker constructed as an integral part of the transformer unit.

Transmission Towers Raised Under Load

Where line relocation requires tower raising Los Angeles Bureau of Power and Light uses portable and adjustable hoisting equipment

CLAYTON M. ALLEN,* Los Angeles Bureau of Power and Light

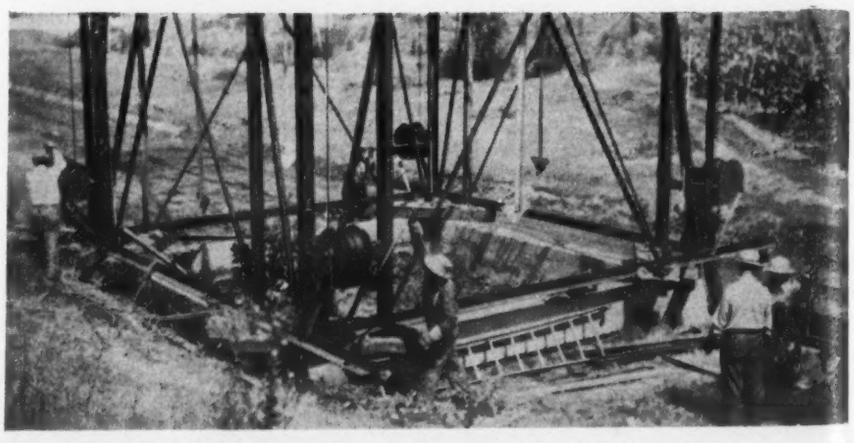
SPECIAL adjustable tower hoists have been used in raising and moving transmission line steel towers while energized. Practically every public improvement, such as opening and widening or changing the grade of highways, railroads, flood-control channels, retarding basins and lower voltage transmission lines in the extensive area traversed by the 110-, 132- and 287-kv. high-voltage systems of the Bureau of Power and Light involving an excess of 1,000 circuit-miles supported by more than 4,500 towers, necessitates the relocation of one or more towers.



RATCHET-OPERATED worm gear which one man can operate

An adjustable angle-iron framework (fabricated in 1941 before the war) has superseded a timber framework with its four chain blocks equipped with extra long chains which had previously been used on many occasions. Designed to raise towers with a base of from 18 to 22 ft., a maximum of 20 ft., the mechanism consists of a ratchet-operated, worm gear and pinion driven drum winch 10 in. wide by 16 in. diameter,

*Senior electrical engineer, Design and Construction Division.



PORTABLE and adjustable hoisting equipment in place raising a 110-kv. tower while energized

mounted on a steel bracket for attaching, one each to the four corners of the 5x5-in. angle-iron framework.

Steel hoisting rope is reeved up over an 18-in. sheave at the top of the framework and down to the lifting bar and guide shoe, one end of which is bolted to the tower leg and the other end fitting into the inside of the vertical corner angle of the raising framework. A tape is attached to each leg so that it is always possible during raising operations to know the exact position of each tower leg and, in that manner, keep the tower plumb.

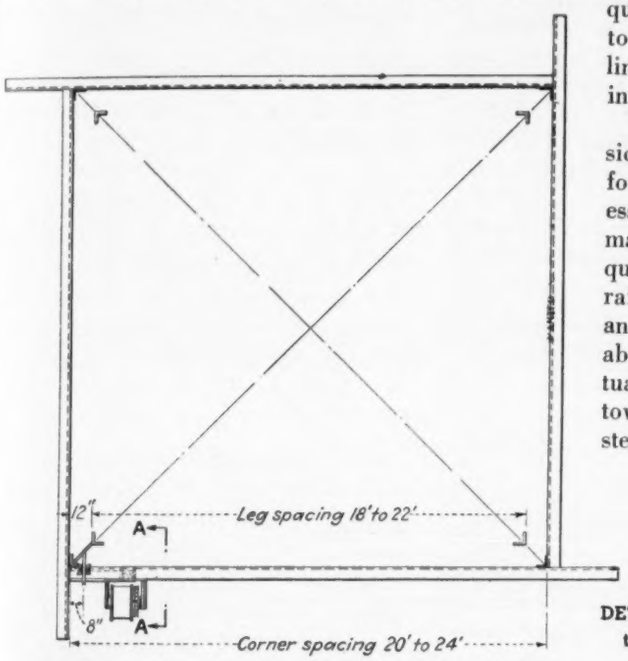
If no conductor or ground wire changes are necessary, the tower is raised while energized, maintaining uninterrupted service and eliminating the time, expense and inconvenience of switching load to other lines, which quite often means Sunday work and, consequently, greater expense.

Railroad Relocated

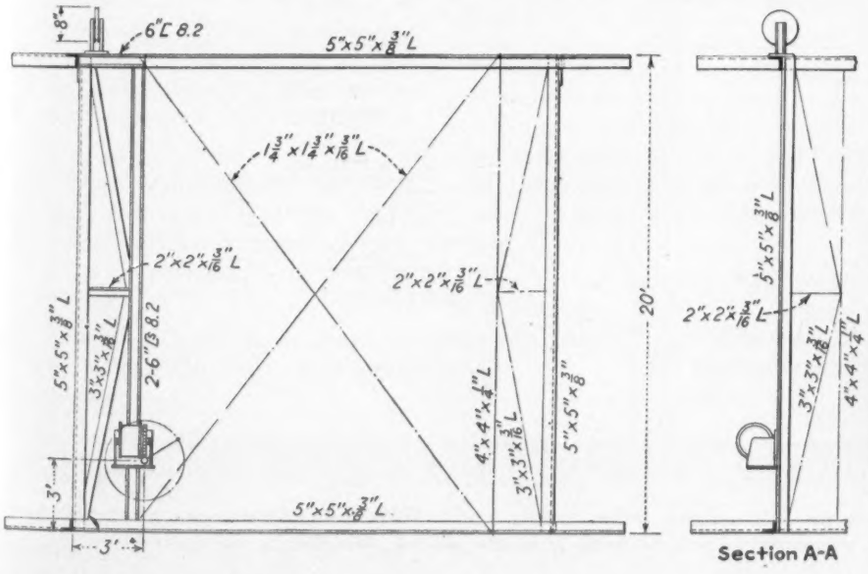
Immediately after fabricating the complete mechanism, opportunity was had to raise two towers 17 ft. on the bureau's 110-kv. double-circuit Seal Beach transmission line along the Los Angeles River on account of the new and higher grade of a railroad, relocated to give clearance for flood control banks being constructed and improved by the U. S. Engineers.

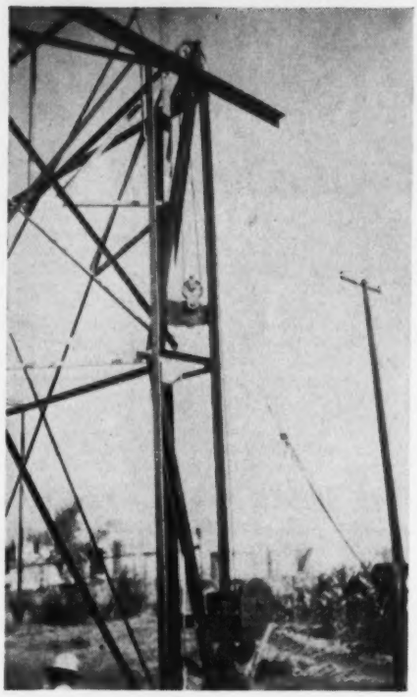
Initial use of the steel frame and winch mechanism proved highly successful and superior to the former wood frame and chain block method. A few improvements were made in the mechanism and, on the subsequent job, two similar towers on the same line were raised "hot" in record time.

With straight extensions, where no new footing work is necessary, four to six man-days are required to set up the raising framework and mechanism, and about four hours actually to raise the tower and set the new steel extension.



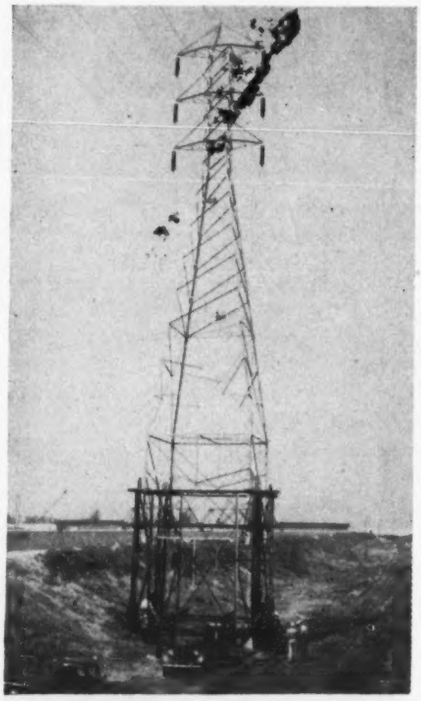
DETAILS of adjustable tower-raising frame





ONE of four hoisting units, showing winch, lifting bar, guide shoe and top sheave

Tower raising operations for the bureau are carried out by Superintendent C. W. Ragan and General Construction Superintendent J. F. Moran under the supervision of G. E. Benkesser, engineer of construction, and R. R. Robertson, engineer of design and construction.



RAISING framework in operation on a double-circuit 110-kv. tower where a straight extension of 17 ft. was involved

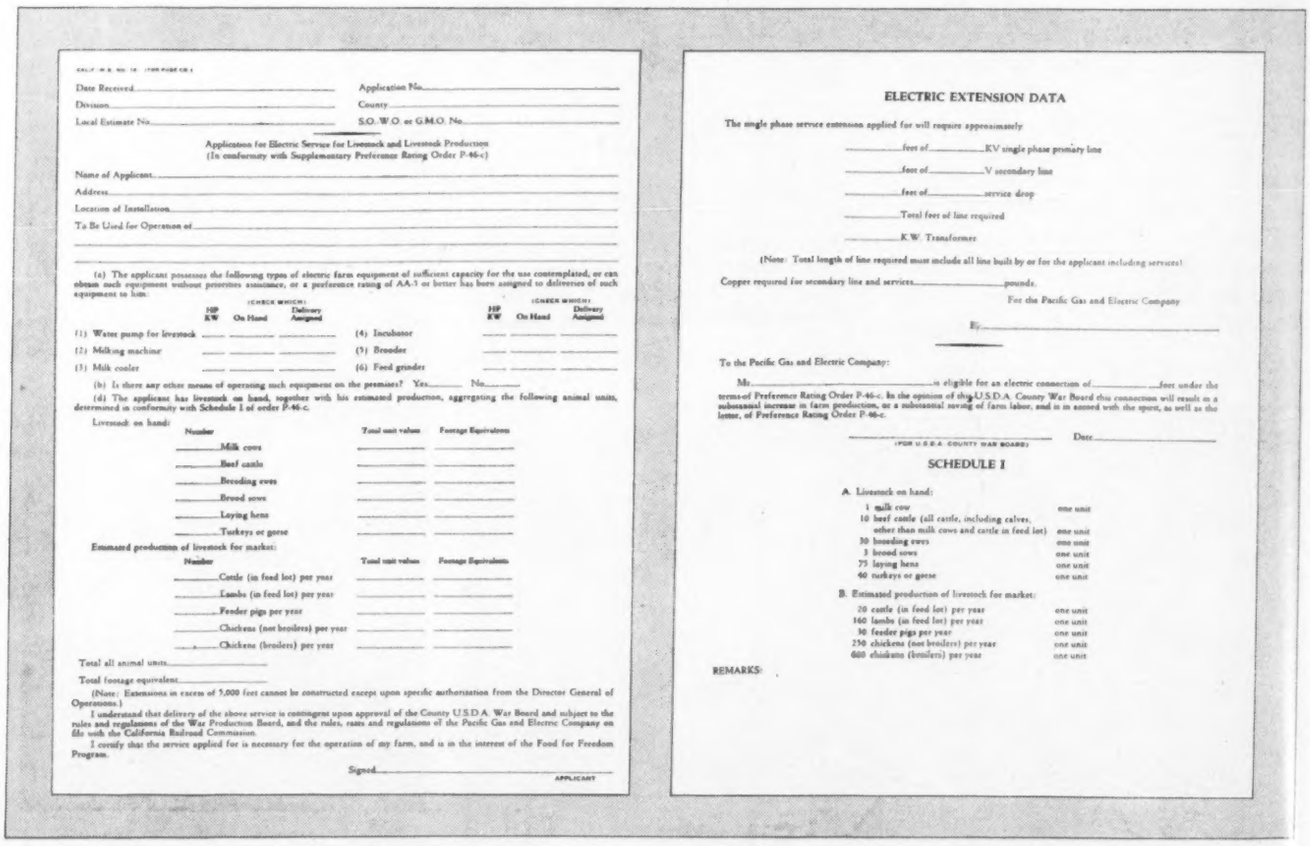
Electric Power Accelerates Food for Freedom Program

Duties and responsibilities of a rural electrification advisory service based on producing a billion dollars worth of farm products in the territory of one utility

A. M. FROST, Manager Agricultural Sales, Pacific Gas & Electric Company

WITH a billion-dollar goal assigned to the farms in its territory as their contribution to the 1943 Food for Freedom program, Pacific Gas & Electric Company has geared its agricultural plan to a ten-point program for assisting farm customers in expediting this production. Within its service territory there are approximately 90,000 farms on or within ½ mile of P. G. & E. distribution lines. Seventy-two thousand of these farms receive electric service; they have a connected load in excess of 600,000 hp. and they use roughly 600,000,000 kw.-hr. annually.

These farm customers use electricity for a variety of applications in food production or processing of crops, resulting in increased yields, lower costs and saving of manual labor. Along with other California electrified farms, they roll up a total farm electric power consumption which exceeds that of the farms in all of the remaining 47 states combined. In spite of the progress to date,



Date Received _____ Application No. _____

Division _____ County _____

Local Estimate No. _____ S.O.W.O. or G.M.O. No. _____

Application for Electric Service for Livestock and Livestock Production
(In conformity with Supplementary Preference Rating Order P-46-c)

Name of Applicant _____

Address _____

Location of Installation _____

To Be Used for Operation of _____

(a) The applicant possesses the following types of electric farm equipment of sufficient capacity for the use contemplated, or can obtain such equipment without preorities assistance, or a preference rating of AA-5 or better has been assigned to deliveries of such equipment to him:

	HP / KW	(CHECK WHICH) On Hand	(CHECK WHICH) Delivery Assigned		HP / KW	(CHECK WHICH) On Hand	(CHECK WHICH) Delivery Assigned
(1) Water pump for livestock				(4) Incubator			
(2) Milking machine				(5) Brooder			
(3) Milk cooler				(6) Feed grinder			

(b) Is there any other means of operating such equipment on the premises? Yes_____ No_____

(d) The applicant has livestock on hand, together with his estimated production, aggregating the following animal units, determined in conformity with Schedule I of order P-46-c.

Livestock on hand:

Number		Total unit values	Footage Equivalents
_____	Milk cows		
_____	Beef cattle		
_____	Breeding ewes		
_____	Brood sows		
_____	Laying hens		
_____	Turkeys or geese		

Estimated production of livestock for market:

Number		Total unit values	Footage Equivalents
_____	Cattle (in feed lot) per year		
_____	Lambs (in feed lot) per year		
_____	Feeder pigs per year		
_____	Chickens (not broilers) per year		
_____	Chickens (broilers) per year		

Total all animal units _____

Total footage equivalent _____

(Note: Extensions in excess of 5,000 feet cannot be constructed except upon specific authorization from the Director General of Operations.)

I understand that delivery of the above service is contingent upon approval of the County U.S.D.A. War Board and subject to the rules and regulations of the War Production Board, and the rules, rates and regulations of the Pacific Gas and Electric Company on file with the California Railroad Commission.

I certify that the service applied for is necessary for the operation of my farm, and is in the interest of the Food for Freedom Program.

Signed _____
APPLICANT

ELECTRIC EXTENSION DATA

The single phase service extension applied for will require approximately

_____ feet of _____ KV single phase primary line

_____ feet of _____ V secondary line

_____ feet of _____ service drop

_____ Total feet of line required

_____ K.W. Transformer

(Note: Total length of line required must include all line built by or for the applicant including services)

Copper required for secondary line and services _____ pounds.

For the Pacific Gas and Electric Company

By _____

To the Pacific Gas and Electric Company:

Mr. _____ is eligible for an electric connection of _____ feet under the terms of Preference Rating Order P-46-c. In the opinion of this U.S.D.A. County War Board this connection will result in a substantial increase in farm production, or a substantial saving of farm labor, and is in accord with the spirit, as well as the letter, of Preference Rating Order P-46-c.

_____ Date _____
(FOR U.S.D.A. COUNTY WAR BOARD)

SCHEDULE I

A. Livestock on hand:

1 milk cow	one unit
10 beef cattle (all cattle, including calves, other than milk cows and cattle in feed lot)	one unit
30 breeding ewes	one unit
3 brood sows	one unit
75 laying hens	one unit
40 turkeys or geese	one unit

B. Estimated production of livestock for market:

20 cattle (in feed lot) per year	one unit
160 lambs (in feed lot) per year	one unit
30 feeder pigs per year	one unit
250 chickens (not broilers) per year	one unit
600 chickens (broilers) per year	one unit

REMARKS:

FORM DEVISED for processing applications for rural service which qualify under WPB order P-46-c; farm power advisers assist applicants in preparing this form in quintuplicate for submission to county U.S.D.A. War Boards for approval

complete farm electrification has not yet been realized, and it is reasonable to assume that California farms will use more than twice the amount of electricity now consumed.

New Kinds of Crops

In 1943, in addition to the normal diversified field crops, such as live stock, fruits, vegetables, poultry and dairy products, these farms are being required to produce badly needed vegetable oils derived from olives, cotton seed, flaxseed, peanuts, soy beans and castor beans, as well as guayule for rubber production. Under these wartime conditions the objectives of the P. G. & E. agricultural program are to:

1. Maintain at the highest possible standard the power service rendered its agricultural customers.

2. Extend these services wherever possible in the best interest of the Food for Freedom program and the general war effort.

3. Work with customers to utilize vital materials to the best interest of the nation and in harmony with the stipulations of authorized government agencies.

4. Aid agricultural customers in the fulfillment of their obligation to the war effort.

5. Cooperate with equipment manufacturers in servicing and distributing the available supplies to the best possible advantage.

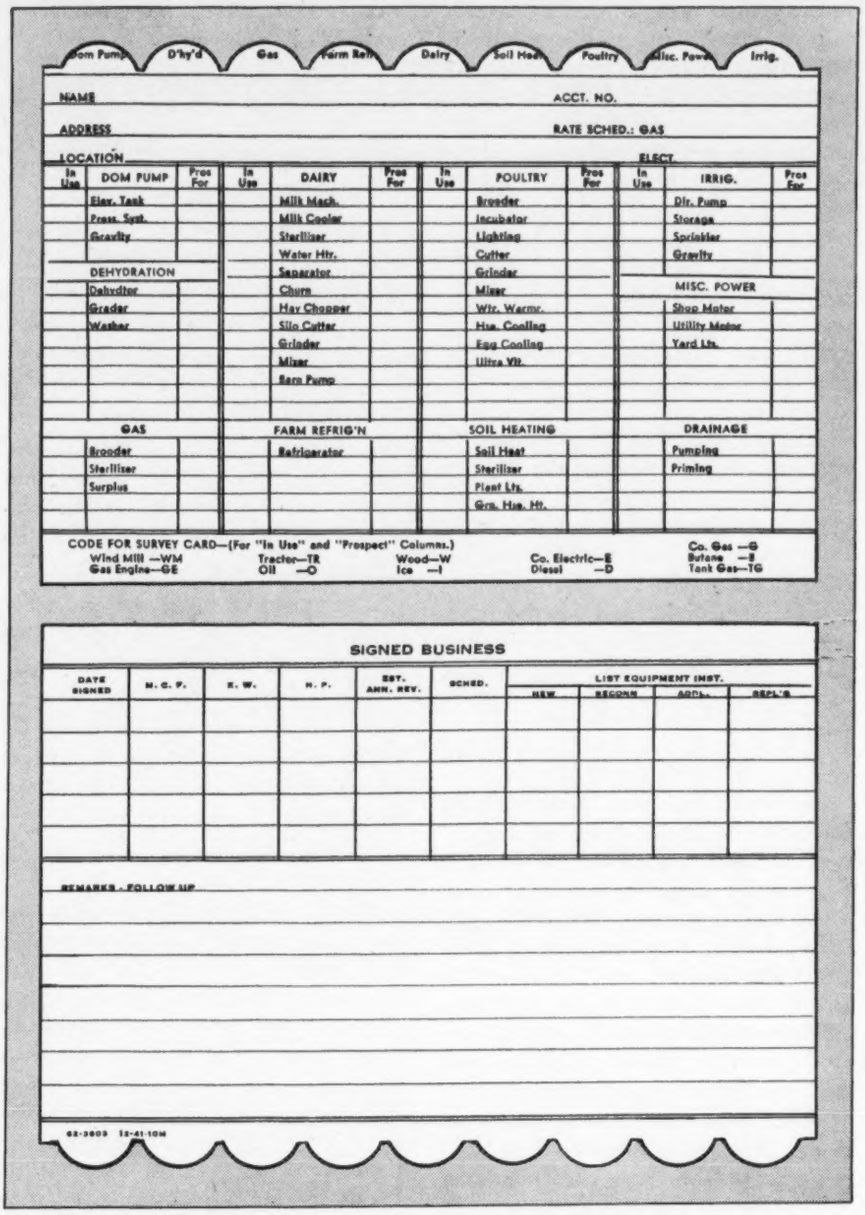
6. Work with county and state U.S.D.A. War Boards on the processing of farm electric power service applications. Scarcity of materials has prompted the WPB to request that only those applications which contribute to the success of the Food for Freedom program be submitted to them.

7. Work with the farm machinery advisory committee of the state U.S.D.A. War Board to promote preventive maintenance of farm electrical equipment.

8. Assist customers, dealers and repair shops with material priority information.

9. Through advertising, publicity and lecture demonstrations, carry on an educational program to (a) support and emphasize the national program for food production; (b) suggest ways and means by which farmers can utilize its services better to meet their responsibilities, and (c) offer suggestions and cooperation in a plan for farm equipment maintenance.

10. Continue its agricultural pump testing service, which is obviously more important now than in normal times.



FRONT AND BACK of survey card used for cataloging present farm power uses and noting additional applications which can be made to increase farm production or efficiency

Save Manpower

One fundamental premise on which this plan is based is that electrical and mechanical equipment must supplant manpower wherever possible. The farmer's electric power service and equipment, therefore, are more important to him than ever before. To achieve the goals set forth in the 1943 Food for Freedom program more highly specialized farming, intensive cultivation, year-round production and a higher degree of electrification possible with the low agricultural power rates available in P. G. & E. territory are necessary.

Increase Load Factors

To this end intensification of effort and elimination of inefficient and wasteful methods are essential. Typical example of how this may be

accomplished would be for electrically operated irrigation systems to work longer hours to irrigate unused acreage without additional plant capacity or plant investment. In the poultry industry, instead of brooding once or twice a year, brooders might be operated almost continuously. It is estimated that existing brooders used to full capacity could produce 100 percent more than they do under present practice. Efficient "Save Metal Victory Brooders" are available for increasing family production of poultry.

Substitution of power-driven equipment can counteract the present tendency to reduce the size of dairy herds on account of labor shortage. Dehydration of farm products can be encouraged. Quick freezing of food, both commercially and on the farm for home consumption, will save cans and preserve for future use seasonal surpluses that might otherwise go to waste.

The Farmer's Helpers

To insure that all of these methods in which electricity plays an important part will contribute to the success of the Food for Freedom program is the purpose of the 1943 agricultural plan. Between P. G & E. as producer of power and the farmer as a consumer of that power stand the 28 farm advisers and the twelve men in the pump-testing crews. These men are qualified by experience and training to bring the two together in a way that will be beneficial to both. The advisers have an understanding of the farmer's problems and a full knowledge of company business methods and policies as they apply to agriculture. They are competent to advise farmers on all equipment which uses electricity and are posted on new developments in equipment and farming methods. Their annual participation in a rural electric conference or short course in agricultural engineering sponsored by the CREA and the state university keep them abreast of new developments, methods and techniques.

Specifically the 1943 agricultural plan contemplates that the farm power advisers will undertake the following duties:

1. Explain to customers the application of the company's rules, rates and regulations; also additional regulations arising from the war program which affect the company's service to its customers.

2. Assist customers in the interpretation of government orders that affect the securing of equipment and repair parts necessary to the use of the company's services.

3. Aid customers in both the sale and purchase of used equipment that is available and in usable condition.

4. Work with customers in every way possible to assist them in their effort to achieve their goals in the Food for Freedom program.

5. Analyze existing service facilities and operating conditions and consult with customers on the efficiency of their equipment and the installation of new equipment.

6. Arrange for pump test and other services as may be necessary to correct unfavorable conditions.

7. Improve the company's relations with its customers by being on the alert for opportunities to correct misunderstandings with respect to the company or its services.

8. Make a satisfactory systematic survey of not less than ten farms per week. These surveys will show the uses being made of electric power on each individual farm and will also show the equipment being used. Also, a record will be made of the additional uses which can be made of electricity to the economic advantage of the farmer and will show the equipment for which the farm can be considered a prospect in the future. These surveys will form a valuable back-log of potential business for the future when equipment will be available and when expansion of facilities may be made under circumstances which will govern after the war.

9. Keep informed on and maintain a record of all competitive power installed in their territories for "after war" prospect lists.

10. Secure all possible new and reconnected business consistent with war conditions.

11. Assist dealers and repair shops with repair and replacement problems, and encourage farmers to arrange with dealers and repair shops for systematic inspection and repair of their equipment.

12. Maintain contact with farm and grower organizations for the mutual consideration of problems affecting agriculture.

13. Assist state and federal agencies and customers in the processing of meritorious applications for the company's services.

14. A new duty of the farm power adviser will be to render all possible aid in the utilization of service in the farm home. This will avoid duplication of effort by domestic men and will be in the interest of transportation and manpower economy.

Irrigation Pump Maintenance

The company's pump testing service assumes a position of prime importance under conditions such as exist today. The purpose of the service is to assist farmers in maintaining their irrigation pumps at a higher degree of efficiency in order that they may secure the greatest possible value from the dollars they spend for electric power. It is intended also that this service will apprise farmers of conditions that indicate excessive depreciation in order that they can take remedial action in time to prevent serious interruptions. Breakdown of pumps is a too-frequent cause of crop failure as well as a loss of vital equipment. In wartime these losses must be avoided. Repair parts for pumps, copper for rewinding motors, and skilled mechanics to do the work, are difficult to obtain.

Stitches in Time

Frequently tests disclose that small adjustments or minor repairs if made in time result in large savings in power consumed and equipment depreciation. On the completion of each test the farmer is given a written report on the general condition of his plant as well as the over-all efficiency expressed in percent, depth to water, draw-down of well, gallons per minute pumped, horsepower load on motor, kilowatt-hours per acre-foot of water pumped and other data of value to him.

Purpose of the entire agricultural plan is to assist farmers in their all-out effort to supply the additional food needed by the armed forces, the civilian population and lend-lease. In this task electric power must play an important role in speeding production and in helping to alleviate a critical labor shortage.

"Keep His America—American!"

"To Provide for the Common Defense ...to Promote the General Welfare"
The Long Road Back
"I Tell You.....There Are Bad Times Ahead"
Keep his America AMERICAN!..
...until Johnny comes marching home!
For three centuries . . .
Through three Crises . . .
America's System of Free Enterprise returned the Nation to Greater Prosperity than ever
In America PROFITS Pay the Cost of Government
A Job For a UNITED America
200 BILLION DOLLAR POST WAR DEBT
and a Challenge to the American System of Free Enterprise!
IDAHO POWER COMPANY
A System that Produced this Result is Worth Keeping!
IDAHO POWER COMPANY

AWARENESS of the responsibility that now weighs on every business institution shines out from this series of newspaper advertisements of the Idaho Power Company.

"Look, Americans!" these advertisements say in climax to each of their several themes, "since the beginning of time the only road to prosperity has been production and exchange of goods and services at a profit—the American system of labor and business.

"From it you have earned personal benefits—your home towns have enjoyed increasing advantages — and your nation has become the richest on earth.

"The American system has created these tangible things for you:

"The highest standard of living in the world.

"The accumulation of personal savings and worldly possessions—your schools, your highways, your buildings—your life insurance, your home, your automobile.

"Money to pay the cost of government, local, state and national, including the payment of governmental debt.

"And with this, you have the right to think, to speak and to worship as you choose—rights forbidden to millions not living under the free American system."

And, at the bottom of each advertisement, too small perhaps to be seen clearly in these reproductions, is the helmeted head of an American soldier with the words quoted for title on this page, "Keep his America —American!"

These advertisements were merchandised, sold in advance. Copies of them were made up and mailed to a thousand or more leading men of the territory served by the company so that these men could—and they did—draw the attention of their fellow citizens to the advertisements when they appeared in the local newspapers.

PRIORITIES PROBLEMS

Excess Inventory Exchange

After March 31 utilities must attempt to obtain necessary supplies of a dozen or so types of critical materials and equipment from the excess stocks of other utilities before they can purchase these items from suppliers.

This is the core of the new mandatory inventory redistribution program being established by WPB's Office of War Utilities under Paragraph J of Utilities Order U-1. Its purpose is to provide a method for using material and equipment which already is fabricated and in company stockrooms wherever possible.

Administration of the plan has been decentralized so that it can be operated quickly and effectively. It will be operated through thirteen regional Utility Inventory Control Offices—locations of which are listed in the box, "Where to Go," printed on the opposite page.

These offices will be "paper warehouses," maintaining continuing records of the surplus inventory of systems in their respective areas and steering utilities needing material and equipment for repair and maintenance, or for construction, to the company which has an extra amount in stock. These offices will be clearing houses, however, not brokers, with no physical possession of, or title to, any material.

The plan applies to all electric, gas and water utilities, but this discussion will be confined to the operation as it affects electric systems. At the outset the plan is to operate on a mandatory basis only for material and equipment listed in Schedule C of Order U-1—for the electric items see the box "The Shelf Stocks," on the next page.

Check With Regional Office

It is important to know that, where items in Schedule C are involved, the redistribution program applies not only to repair and maintenance, but also to new war construction by utilities. In other words, before buying any of the specified equipment for any purpose, utilities must check with their regional office to see whether some other system has the needed items in stock that can be spared.

Use of the regional offices is not, however, confined to the Schedule C material and equipment. Continuing inventories will be maintained of other commonly needed items and detailed records will be kept of spare units of special equipment in an effort to make the redistribution of existing inventories stretch as far as possible. From time to time other items are expected to be added to Schedule C and put on a mandatory basis as supply conditions warrant.

Here is how the plan will work:

1. When a utility requires types of material or equipment listed in Schedule C it sends an inquiry to the regional office in its area. Inquiries *may* be made for non-listed items, but they *must* be made prior to placing a purchase order for the listed items. The only exceptions are for emergencies or when the order involves less than $100. The inquiry must be in duplicate. Telephone inquiries may be made, but these must be confirmed. The form of inquiry is optional—write a letter or use the regular company price inquiry form.

2. The regional office will determine whether the required items are "reasonably available" in the excess stocks of other utilities. In possessing delegated authority to interpret "reasonably available" the regional offices may weigh quantities of critical raw materials and manufacturing processes involved in the wanted items against the transportation, manpower and other war factors. Thus, in some cases they may release the order for purchase from a supplier, even though a utility a few hundred miles away has such items; in others the situation may justify finding an item and shipping it clear across the country.

3. If the material is found a copy of the inquiry will be returned with a notation showing the company which has the material and the name of the man to contact. From there on it's up to the two utilities to agree on terms, but a company which refuses to accept a bona fide offer can be denied further priorities assistance by the Office of War Utilities (paragraph K, Order U-1).

4. If the required material is not listed in the excess stocks of systems in the area the regional office will poll adjacent offices, or the whole nation where further search seems justified. If it's an emergency case, all regional offices will be contacted. Where this search fails to locate the needed items, the regional office will so notify the company and authorize it to place a purchase order with a supplier in the normal manner.

5. Duty of reporting sales of material and equipment which is carried on regional office lists rests with the selling company. This should be

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℞ THERE is no formal definition in Order U-1 covering what constitutes an "emergency" situation for which the mandatory redistribution procedure may be waived. It's deliberately left up to utilities to use their judgment. For instance, if a piece of equipment needed in a hurry is known to be on a local supplier's shelf, it would be a waste of time to locate it in another utility's warehouse and ship it. On the other hand, if the item had to be shipped by the supplier or manufacturer it probably wouldn't take any longer to get it through the regional office. A good rule is to use the telephone, explaining the circumstances; the regional offices have discretion to waive the procedure.

℞ DIRECT DEALINGS between utilities involving sales and exchanges from inventories are not halted by the program for re-distribution of surplus materials outlined on these pages. Utility A, needing a power transformer which Utility B can spare, can negotiate the purchase without clearing through the regional WPB office. So, too, can utilities redistribute among themselves items which haven't yet been included in the program. Only requirement is that the selling company must report to the regional office sale of any material or equipment which is listed there as surplus available for sale, so that it can be removed from the records.

THE SHELF STOCKS

Here is the list—taken from Schedule C of Utilities Order U-1 — of material and equipment which utilities must attempt to obtain through OWU's Inventory control offices from surplus stocks of other companies after March 31:

Wire, cable and bus bar shapes (all types).
Transformers—power, distribution, current, and potential.
Watt-hour meters.
Circuit breakers (oil and air).
Disconnecting switches.
Electric motors.
Suspension insulators.
Lightning arresters (20 kv. and over).
Steam valve, piping and fittings over 3 in. and over 300 psi.
Regulators feed voltage.
Fuse cutouts.
Automatic line splices.

done as soon as the transaction is arranged, so that the regional office can withdraw the item from its "shelf stock" list. A "headache" requirement for every one is that reports must also be furnished monthly of surplus used by the utility itself. The OWU staff realizes that this is a burdensome requirement, but has as yet no other solution to the basic need for a reasonably accurate "perpetual inventory" type of record of the surplus stocks.

All this occurs before a purchase order is placed for any of the types of material and equipment listed in Schedule C. It is the intention, however, of OWU's Inventory Control staff, that these added steps will take a minimum of time.

That is why the inventory redistribution program is being started slowly, with only the most critical items of material and equipment covered on a mandatory basis. It is why, also, the catalogs of "shelf stocks" of the regional offices, at the start, won't be 100 percent complete.

The regional offices are setting up their continuing inventory systems of material and equipment which utilities hold in quantities exceeding the maximums allowed in the old Order P-46 (paragraph F-2). The original lists are compiled from the WPB-921B report requested of Class 1 systems in January of this year. These show the excess inventories, by quantity and quality, as of December 31, 1942. Most companies already have been requested to be prepared to report all disbursements from listed surplus stocks which have been made since the 921B report for December 31 was filed.

Over a period of time, two other listings of surplus stocks are to be added to the records—those held by companies which have not been asked to report on Form WPB-921B and the additional "surplus stock" created by revision of the maximum permissible inventories in Paragraph F-2 of the new Utilities Order U-1 in the holdings of those companies which have reported on 921B's.

These will be accumulated, in part, automatically, as companies segregate their excess stocks to take advantage of the "short item" purchase procedure of Order U-1 (ELECTRICAL WORLD, March 6, page 59), and by sending out additional WPB-921B report blanks. Eventually, it is anticipated, the 921B's can be dispensed with, inasmuch as withdrawals from listed excess stocks will be coming to regional offices automatically as redistribution sales are completed, or withdrawals made.

Primarily, this program is intended to effect a redistribution of surplus stocks among utilities. The regional offices lists, however, will be available to others—the Army, Navy, Maritime Commission and war plant operators with electrical systems which often require material and equipment similar to that used by power companies, and materials and equipment may be sold to such organizations, if they hold appropriate priority ratings, with further clearance through the OWU. This sharing will work the other way, as well. The regional offices, as soon as they can handle the work, are to secure information and control over existing surplus stocks of materials and new and used equipment in the hands of non-utilities which are regularly needed by utilities.

On the matter of price regulations in this redistribution program, the picture today isn't as clear as the procedure itself. Prices at which new and used materials and equipment may be sold or exchanged under this program are subject to OPA price regulations Nos. 136 and 204, but admittedly these are often awkward to apply to dealings involving companies not ordinarily in the business of selling. OWU is attempting to secure some simplification of these orders as they apply to transactions under this program, but until this is worked out the regular OPA regulations are in force.

WHERE TO GO

Following are the locations of the Office of War Utilities' Inventory control offices through which utilities must clear after March 31 under the inventory exchange program before purchasing specified types of new materials or equipment for repair, maintenance or operating supplies, or for construction:

City	Address	Phone	Territory
Boston	17 Court Street	Lafayette 7500	Conn., Maine, Mass., N. Hamp., Rhode Island, Vermont
New York	122 E. 42d St.	Murray Hill 3-6805	Northern N. J., New York
Philadelphia	1617 Pennsylvania Blvd.	Locust 3400	Del., Md., Southern N. J., Eastern Pa., Va.
Atlanta	116 Candler Bldg.	Walnut 4121	Ala., Fla., Ga., Miss., N. C., S. C., Tenn.
Pittsburgh	801 1st Nat'l Bank Bldg.	Grant 5370	Western Pa., W. Va., Ohio, Kentucky
Chicago	226 W. Jackson Blvd.	Andover 3600	Ill., Ind., Iowa., Wis.
Kansas City	Mutual & Interstate Bldg. 13th & Locust St.	Victor 7780	Ark., Kansas, Mo., Neb.
Dallas	910 Fidelity Bldg.	Riverside 5711	La., Okla., Texas
Denver	Kittredge Bldg.	Tabor 3173	Colo., Mont., N. Mex., Utah, Wyoming
San Francisco	1355 Market St.	Klondike 2-2300	Calif., Nev., Ariz.
Portland	Bedell Bldg.	Broadway 3471	Wash., Ore., Idaho
Detroit	7310 Woodward Ave.	Trinity 2-4900	Mich., Ohio (Toledo)
Minneapolis	326 Midland Bank Bldg.	Main 3244	Minn., N. Dak., S. Dak.

Editorials

S. B. WILLIAMS, *Editor*

Power Adequacy After the War

ALTHOUGH time and again it has been shown that World War I is no reliable guide to what will happen in this war, we cannot refrain from pointing out that in the first year of peace, 1919, the utility industry experienced a drop in load factor and an increase in peak. The next year the peak increased 10 percent and the load factor was better than in the last year of the war.

There is a reason for this, and while there may be a difference in degree between the two wars, we cannot escape the logic of events. Peacetime production will be put back after the war just as fast as possible and on top of that will come the demands that have been restricted during the war. Dimouts, for instance, will give way to lots of light.

Thus the peak is bound to go up and as labor is found to run the machinery of peace hours will be lengthened to give a better load factor.

The important thing, therefore, is that while war may be safe from any difficulty in power supply we have not the same assurance for peace in the industrial areas.

With the repeal of brownouts and dimouts and wartime, it is easily possible that peace demands the second year after the war could impose an added peak for the country equal to half the present dependable reserve. If anything like that is in the picture, then obviously the present is none too soon to make preparations for additional generating and system capacity so that work can go ahead at the first possible moment.

Uprising Against Tax Diversion

THIS WEEK a bill was passed in the Georgia House taxing federal agencies that might come into the state on the same assessment basis as private business with which they would compete. This is but the forerunner of other bills in different states offered as a protest against the reduction of state tax receipts from public ownership of utilities.

In the Georgia case the assemblymen were concerned with the fact that FPC had offered Georgia Power a hydro license that stipulated terms under which the government could purchase the properties. Of course, all FPC licenses have reserved for the government the right of acquisition. Now, however, the Georgia people begin to see that that means something more than just a protective clause. They have seen what happens to local revenues when the government steps into the utility ownership picture—and they don't want any of it.

There is another side to this matter that other states are beginning to see, and that is state and county tax losses from properties purchased by cities. The high federal taxes make these buys especially attractive to cities—so attractive, in fact, that they can afford to offer prices to present owners that are far greater than private purchasers could pay.

No political subdivision can tax the property of the sovereign government, no matter what law it passes. On the other hand, if the property is purchased by some quasi-public body with money loaned by the federal government, that is something else. In the case of conversion of ownership within a city, however, the state is the sovereign body and has the power to protect its tax revenues. The states and counties, and that means the farm folks, are just beginning to wake up to the threat of public ownership. The goose will not keep on laying golden eggs if its head is chopped off.

The Role of OPA and Byrnes in Rate Matters

THE anti-inflation bill of last October prevented utilities from making any general increase in rates after September 15 without 30 days notice and consent to intervention. The bill specifically mentions "increase" and "in effect September 15."

Regardless of these defining words, OPA and the President's representative, Justice Byrnes, are intervening in the Potomac Electric case (1) to reduce the rate and (2) to limit the corporate income tax that may be allowed as an operating expense to that in effect prior to the start of the war in Europe—19 percent. FPC had already set pre-Pearl Harbor in other cases.

A previous law specifically withheld utility rates from OPA jurisdiction, but that didn't stop the price administrator. He wanted full control over utility rates, or at least full veto power over rate increases. This the Congress was unwilling to grant, but did go part way in permitting intervention. Now it appears that this concession is not enough. What OPA wants apparently is nothing short of full authority over utility rates.

The anti-inflation bill was for the purpose of preventing a runaway price market. It was never intended as a substitute for regularly constituted regulation. In the Washington case, however, OPA and Economic Stabilizer (?) Byrnes are insisting on a price decrease, and in order to get it want the commission to revert to pre-Munich days for allowable taxes.

Is there any reason back of what these fellows are doing? Yes, indeed, the reason undoubtedly is to so hamstring the utility that it will be forced to sell to the government. The Treasury counsel let that cat out of the bag in the beginning. His statement was withdrawn later after it had raised a storm of protest. But mere withdrawing of a statement made in earnest does not necessarily change intent.

Last fall, when one of the OPA counsel told the National Association of Railroad and Utilities Commissioners rather frankly what was expected of state regulation, the commissioners didn't like it. Leon Henderson, then in the neighborhood, hurried over to assure the commissioners that OPA had no intention of interfering with their operations. OPA, however, has a new boss now.

The state commissioners are already resisting the Federal Power Commission in what they claim is usurpation of jurisdiction, and now that they know what OPA is up to perhaps they will have another case on their hands. This Washington case is by no means confined to that city, for if OPA and Byrnes can force a rate cut and if they can establish a precedent for pre-Munich tax allowances the energies of the OPA utility department will know no territorial bounds.

Is this what America is fighting for?

Deferment of Linemen

WOMEN are reported in social circles as being good climbers, but that propensity means nothing as to climbing poles. Climbing poles is a man's job and a young man's job at that. There are men above 50 in some line gangs, but many at that age admit that they "lose their starch" and cannot keep it up. To work in the air among live wires takes muscular coordination and constant alertness, with capacity to observe the requirements of safety. Stiffening muscles and joints, along with slowing reactions, make age a handicap for such exacting and hazardous tasks, and the men themselves are first to admit it.

Restoration of the 45-year draft limit puts a premium on deferments for young and middle-age linemen, to say nothing of the patriotic pressure for the men to vacate their deferments and join up. Among the groups rated as indispensable to uninterrupted power service to war industry linemen should stand high. Without an adequate number of them on hand to go out in all kinds of weather to repair the damage done by storms there would be the risk of delays in restoring service to important industrial loads. Admittedly construction work is at low ebb, but such gangs as have been retained deserve consideration by draft boards when they weigh the value of a man's service in the armed forces as contrasted with his value in such an essential back-up function as keeping the wires up and keeping them hot.

Another Form of Electrical Transportation

ELECTRICITY seems destined to stay in the field of transportation even if street railways yield to buses and steam railroads fail to electrify as hoped at one time. Now it's oil pipe lines in a bigger way than ever. That 24-inch line from Longview, Tex., to Phoenixville, Pa., is going to send to the Middle Atlantic area some 300,000 barrels a day, as much as 30,000 tank cars could deliver. That equivalent of 300 trains, more or less, is going to require an estimated aggregate input of 777,000,000 kw.-hr. each year for the 26 stations dotted at approximately 50-mile intervals along the 1,388-mile stretch.

Twenty-six utilities will share a revenue of some $6,000,000 a year from the service they render to the 725-psi. pumping stations. They will thus collect almost half the annual capital-and-operation cost of $14,300,000 on the $95,000,000 investment.

In a recent issue of the *Oil and Gas Journal* W. H. Stueve, the electric engineer of War Emergency Pipelines, Inc. (he is widely known as a petroleum-electrification authority of the Oklahoma Gas & Electric Company), tells that these pumping stations will range from 1,500 to 5,000 horsepower and total 119,800. Rumors are heard that the stations may be doubled in number so as to double the capacity of the line. That, plus a parallel 20-inch "products" line, will still further enhance the stake of the electrical industry in the program of moving petroleum products to the Eastern Seaboard.

Victory Garden Assistance

SEVERAL utility companies have opened victory garden information booths with the co-operation and assistance of either the county agent or the local gardening clubs. The early reports all are enthusiastic and indicate a great interest on the part of the public.

To some it may seem a long way from vegetable gardens to electric service, but it is, in fact, only the initial step in a nutrition program. First, the customers need help in preparing and planting gardens, and then they will need more help in canning the things they grow. That is very definitely within the home service jurisdiction.

And there is another side to this activity—public relations. People during this war will have many opportunities to learn that public utility service means more than rendering a bill. People will begin to see that utilities are not the cold corporations they thought they were.

And just in case we forget, the public has been in the habit of visiting the showrooms of utilities. Even if there are no appliances to sell, let's keep them coming in. Let's whet their appetite against the day when electrical devices are not rationed.

Washington Comment

By GEORGE E. DOYING, Jr., Washington Correspondent

The Men Behind the Utility Director

J. A. KRUG's "war cabinet" for the power side of WPB's Office of War Utilities is a fusion of government career men and industry technicians into a precision team. There's seven of them in all, if two of the more recent additions to the staff are added to the old guard contingent which has been on the job almost continuously since Krug's arrival in mid-1941.

The No. 2 man in the OWU hierarchy today is an old hand who is back in a new and bigger job—Edward Falck, the deputy director. With Krug now both the wartime utilities czar and the WPB vice-chairman for materials distribution, Falck appears destined to come into increasing prominence.

Deputy-Director

Ed Falck is the only "hybrid" in the Krug cabinet, having served a hitch both with Tennessee Valley Authority—which is where he first met Krug—and with Consolidated Edison Company. A native New Yorker with a B.S. and M.S. in engineering from Columbia University, his peacetime career was as a rate engineer.

He was around the power division for more than a year in 1941 and 1942, but he seldom got into the limelight. That's largely because the assignment Krug originally gave him never materialized into front page stuff. Falck was the man who was charged with rationing energy when it got short—which it uniformly hasn't done.

His emergence as Krug's second in command at OWU is, however, no accident. Falck has a flair for administrative technique.

It was Falck who, during the Southeast drought emergency of November, 1941, improvised on the spot the pattern for commercial and industrial power rationing which since has been incorporated in the basic power and gas curtailment orders, and has been adapted for oil allocation.

When Krug, last summer, shifted from power to materials distribution, he took Falck along as his deputy. The two men have worked side by side during this interval—almost literally. Their offices flanked a common secretarial and visitors' waiting room and they began riding in the same auto pool to and from their suburban Maryland homes. Falck's return to utilities as Krug's right-hand man was, as a result, simply a natural sequence of events. It was, as well, a welcome one among the power staff generally.

A couple of corridors from Krug and Falck, in the Social Security Building which is WPB's home base, is Herbert S. Marks, who was introduced on this page last August (ELECTRICAL WORLD, August 8, 1942, page 66). As counsel for OWU and Krug's closest adviser on policy matters, Marks is a minister without portfolio in the Krug "cabinet." Like Falck, Marks is an associate of Krug's from pre-war days at TVA. He was an enthusiastic supporter of the move to bring Krug back to direct the war utilities program and willingly surrendered the power division directorship to return to the legal work he much prefers.

Power Division Director

Directly on the firing line in the power section of OWU is Barclay J. Sickler, who as director of the Power Division is No. 3 in authority—as well as the third occupant of the northeast corner office, room 2085, of Temporary Building "R."

Sickler's present "tour of duty" in Washington is his second. He was head of the research and statistics unit of the original Krug staff, then returned to Bonneville Power Administration, where he is chief of rates and statistics. Krug brought him back in 1942 to supervise all power priorities. From there he moved up to the deputy directorship when Marks succeeded Krug, and into the front office when Marks vacated.

Technicians

Across an ante-room from Sickler is J. E. Moore. When it comes to matters involving power supply, pooling and production plant, it is "J. E." who is called upon. Moore is the chief consulting engineer of OWU, a job the scope of which might be likened to the sum total of the duties of all the utility consulting engineers of the country. It's his task to execute the big power expansion program which has been scheduled to meet wartime loads. From his experience in a similar capacity with Ebasco Services before the war, Moore is used to such a spread-out assignment.

"J. E.'s" counterpart on the equipment side of the utility plant picture is Walker Cisler, whom Krug brought to his staff from a chief engineer's post with Public Service Electric & Gas Corporation of New Jersey. Cisler handles the manufacturing end of the expansion and construction program, executing the scheduling policies of OWU in constant contact with the manufacturers.

These men are the old guard. The multiplying problems of wartime administration are adding perhaps two more to OWU's "war cabinet."

The New Members

William A. Lyons, once comptroller of NY-Pa-NJ Utilities Company, has Falck's old job of rationing, which assumed considerable importance in the gas field this winter. Added to rationing under Lyon's wing now are the increasing problems of fuel supply.

The other newcomer is Charles E. Kohlhepp, who has been borrowed from a vice-presidency of Wisconsin Public Service Corporation to set up OWU's program of redistribution of surplus inventory. This is an assignment to put perhaps $75,000,000 worth of already fabricated items of power, gas and water system material and equipment to active war work so as to obviate the need for that much copper and steel and similar scarce material.

NEWS OF THE WEEK

Power Program Up-Rated to Hold Present Schedule

Advent of other "urgent" programs has put power schedules behind three weeks — OWU gets "blank check" authority to issue AA-1 ratings on bottleneck items up to $5,000,000 value

The 1943-44 power expansion program has been up-rated from the AA-3 and AA-4 level to AA-2X by the WPB Requirements Committee on the recommendation of the Office of War Utilities. In addition, OWU has been granted "blank check" authority to issue AA-1 ratings for bottleneck items up to an aggregate of $5,000,000 of value.

Designed to Hold Schedule

Up-rating of the power program was done to prevent further slipping in the schedule for installation of generators and transmission lines required for war loads. The advent of other so-called "urgent" programs, such as rubber, octane gasoline, escort vessels, etc., in recent weeks has put power schedules an average of three weeks behind the OWU schedule. It is not anticipated that the up-rating will reclaim the lost time, but it is expected to prevent further delays.

In petitioning for higher rating, OWU Director J. A. Krug pointed out that the power expansion schedule as now laid out represents less than one-half the volume of capacity expansion which had been planned by utilities for this year and next. Thus, with the program cut to "bare bones," he urged the necessity of maintaining the schedule of installations in harmony with the added war loads for which the generators are earmarked.

OWU's power supply engineers expect the fall months of this year to be the "tightest" period of 1943 or 1944. A large portion of the scheduled power installation is due late in the year, in time for the normal annual peaks, while many of the new war plants will be taking full quotas of energy by fall. Scheduled completion of many of these plants also has been delayed, but not as much as the power program in some localities.

Use of OWU's "bank account" of AA-1 ratings is expected to be sparing. It will be granted only for individual items of equipment for a particular project, and only as a last resort measure to maintain the schedule.

PLEDGE FOR SERVICEMEN—James P. Davies, Commander Association of Edison World War Veterans, notifies the 415 Boston Edison employees now in the armed services of a guaranteed pledge made by the association in the name of each to the Greater Boston United War Fund

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New Order Provides Limited Connections

Modifies Order U-1 on buildings authorized under WPB L-41

Supplemental Utilities Order U-1-d provides blanket authorization to electric, gas and water companies to construct service connections, within specified dollar cost and materials restrictions, for buildings authorized under WPB's construction order L-41.

The new order, modifying the prohibition against system expansion in Order U-1, is expected to cut down materially the volume of paperwork required of utilities prior to making connections which are virtually automatically approved. Extensions for two types of building construction are involved—where the building is authorized under L-41 with a priority rating to obtain materials and where construction with materials already on hand is authorized by the Construction Division.

In these cases, electrical extensions may be made under U-1-d without additional authorization if: (1) The cost of the extension is less than $500 for overhead or $1,500 for underground construction, and (2) not more than 60 pounds of copper is required in the case of commercial or industrial buildings or if the connection can be made within the limits established by the Housing Utility Standards in the case of residences.

There are still two types of extensions for which utilities must obtain prior authorization. One involves old buildings, already wired, for which service

is now desired. The second involves construction work which is exempt from Order L-41 but which requires new or additional utility services. The Office of War Utilities is understood to be considering further authorization to utilities to make service connections in these types of cases without the paperwork of PD-1A or U-1 letter applications.

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Arizona Authority Bill Hearings Held

A joint hearing before Arizona House and Senate committees was held recently on a proposed power and water authority bill sponsored by Governor Osborn. The proposed measure aims to set up a state agency with powers to deal with the federal government in bringing benefits from federal development of the Colorado River to the state. It would grant broad powers for engaging in various utility activities.

The law is patterned after the California Water Authority act set up to permit state development and administration of the Central Valley project and is held up as the only alternative to ratification of the Colorado River Compact as a means of securing Colorado River water and power in large quantities for the state.

Many groups are opposing the measure. Among them is the Salt River Valley Water Users Association, which already furnishes water and power to a large section of the state in the vicinity of Phoenix.

Bill Introduced on CRC

A bill has been introduced in the Arizona Legislature which seeks to secure state ratification of the Colorado River compact, initial document allocating benefits from that stream to upper and lower basin states. A measure ratifying the compact was enacted by a previous Legislature, but a condition of the measure, that an agreement be obtained between California, Arizona and Nevada as provided in the Boulder Canyon project, was never met.

Recognized as the law governing development of the river, the Boulder Canyon project act specifies that water division between Arizona, Nevada and California be based upon rules to be incorporated in an agreement between the three. Such an agreement has not been reached, principally because of failure of Arizona and California to effect a compromise. Arizona charges that California has received the major benefits from the Colorado River development so far and that California does not want the compact ratified.

"Carrier" Utility Granted FPC Hearing

The Federal Power Commission this week announced its willingness to grant Washington Water Power Co.'s request for a hearing reviewing FPC's order directing the utility to act as a "carrier" for Bonneville Power Administration energy to an Army hospital near Spokane, in the company's service area. In announcing its decision, however, FPC asserted that it considered a hearing unnecessary and involving "unnecessary expense."

FPC's "carrier" order was the first exercise by the agency of the Presidential directive arming the commission with authority to see that the government obtains the "cheapest" source of energy for war needs. Kinsey M. Robinson, company president, appealed for a hearing on the grounds that the load involved is not larger than the "reasonable minimum" specified by the President, that Washington Water Power was buying only a portion of the energy needed to serve the load and that, considering the company's taxes, its rate actually was cheaper than Bonneville's.

The commission's reply, granting a hearing while in effect serving notice that a hearing wouldn't alter its decision, asserted that the company has inadequate dependable capacity for 1943 loads, while Bonneville has surplus capacity. Neither the "reasonable minimum" nor the tax points raised by Mr. Robinson are mentioned in the commission's reply.

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Detroit Edison Elects Parker General Manager

At the annual meeting of the board of directors of the Detroit Edison Co., following the annual stockholders' meeting held this week, the following officers were elected: Alfred C. Marshall, president; James W. Parker, vice-president and general manager; Sarah M. Sheridan, vice-president; Philip J. Savage, vice-president; Russell W. Symes, secretary and general accountant; Arthur D. Spencer, treasurer and Harry A. Snow, controller.

Before his promotion, this week, Mr. Parker was vice-president and chief engineer of the company, having joined the Detroit Edison organization in 1910 as a boiler room engineer at the Delray plant. Mr. Marshall, who continues as president, was appointed general manager in 1923. In 1940 he succeeded the late Alex Dow as president.

NEWS BRIEFS

GEORGE D. BOGGS, machine repairman in the Newark, Ohio, factories of Owens-Corning Fiberglas Corp., is $170 richer as a result of a suggestion he made for conserving critical metals. In each of certain machines used by

the company in making Fiberglas materials one part wears out. Boggs noticed that elements of this part showed no wear. Instead of junking the whole part, these elements are now salvaged.

ONE OF THE FOUR LATEST ELEVATORS installed in Grand Coulee Dam by the Otis Elevator Co. is the largest in the U. S., according to the Bureau of Reclamation. Its platform can carry 30 people. From the top of the dam the shaft drops 362 feet—the equivalent of a 30-story building.

A LARGE SHIPMENT of silver from U. S. Treasury vaults has arrived at the Lake Catherine, Ark., aluminum plant and shortly will be put to use for busbar and wiring, according to a recent dispatch.

FORTY FEDERAL, STATE AND LOCAL AGENCIES are co-operating in the Central Valley Project studies, Commissioner John C. Page of the U. S. Bureau of Reclamation has announced. The bureau has outlined 24 basic problems to determine how the project can contribute most to the war and to postwar readjustment.

19% Income Tax Allowance Sought in Rate Case by OPA

Economic czar Byrnes joins price agency, at Potomac Electric Power rate hearing, in seeking pre-European war income tax allowance rather than 31% pre-Pearl Harbor rate fixed by the FPC as wartime rate policy

Contention by both the Office of Price Administration and Economic Stabilizer Byrnes that only the pre-European war federal corporate income tax of 19 percent should be allowed as a utility operating expense featured this week's Potomac Electric Power Co. rate hearing in Washington, D. C.

Last year, in a precedent-establishing decision, the Federal Power Commission fixed the pre-Pearl Harbor income tax rate of 31 percent as its policy in wartime rate cases. OPA accepted this level in the Washington Gas Light Co. case before the same regulatory body that it now appears to urge the 19 percent allowance.

Would Double Rate Cut

Use of the 19 percent income tax allowance would double the rate reduction which District of Columbia Public Utilities Commission analysts have indicated could be made this year under the Washington "sliding scale" contract. Using the 31 percent tax allowance, PUC analysts have indicated that a rate cut of $315,540 is in order. Allowing only a 19 percent tax would make the cut $648,486.

The government's resort to the 19 percent tax allowance strategy came when hearings were resumed under the PUC's ruling refusing the demand of OPA, Byrnes and three other federal agencies that the sliding scale agreement be scrapped, and limiting evidence to application of that contract to 1943 rates.

Aside from this new angle, the hearings continue to feature personal bickerings between the commission majority and the government lawyers and the commission minority. Minority Commissioner Hankin and the government lawyers joined in protesting Pepco's introduction into evidence of the FPC typical bills analysis for thirteen cities. Objection was on the ground that the typical bills were not pertinent without comparable operating costs. Decision was reserved by the PUC majority.

This week's hearings also were featured by a formal withdrawal by Thurman Hill, counsel for Treasury's Procurement Division, of his previous statement that the government could use other remedies, such as public ownership or seizure of Pepco under the War Powers Act, if a substantial rate cut was not forthcoming. The remarks, Mr. Hill said for the record, were his own personal opinions and not the attitude of the agency.

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PUD Buys West Coast Power Properties

The Federal Power Commission recently authorized the sale to the Clatskanie People's Utility District of such of the West Coast Power Co.'s electric facilities in Columbia and Clatsop counties, Oregon, as are subject to the commission's jurisdiction.

Facilities covered by the order include a substation at the Westport Lumber Co. and an 11-kv. transmission line connecting with facilities of the Bonneville Power Administration. The West Coast Power applied for the authorization and will receive a total of $150,000 for the properties.

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PUD Can Operate Outside District, Court Holds

Oregon Supreme Court recently ruled that a people's utility district has authority to sell and distribute power outside its own boundaries, and that it can pledge revenues received outside the district for paying off revenue bonds.

The opinion was written by Justice Harry Belt in a case involving the central Lincoln People's Utility District. The district directors authorized $850,000 in revenue bonds, of which $735,000 was to be used for purchasing the distribution system of the West Coast Power Co. The district intends to use Bonneville power.

The right of the district to serve outside its boundaries was contested by four taxpayers who contended that the bond issue was illegal because revenues from outside the district were pledged to pay off the bonds.

WESTINGHOUSE SCHOLARSHIPS AWARDED—Vice President Wallace congratulates Ray R. Schiff, 16, of New Rochelle, N. Y., and Gloria I. Lauer, 17, Ames, Iowa, on receiving the top awards in the second nation-wide Science Talent Search just concluded in Washington. Young Schiff and Miss Lauer, who is from Mr. Wallace's home state, each received a four-year Westinghouse Science Grand Scholarship of $2,400. The Science Talent Search, conducted among the nation's million high school graduating seniors, is sponsored by the Science Clubs of America and the Westinghouse Electric & Manufacturing Co.

A.S.T.M. Committees Act on New Specifications

Deliberations in Buffalo, New York, Cleveland and other centers to result in changes in specifications on insulators, insulating oils, rubber insulation for cable, and others

Technical committees of the American Society for Testing Materials, which usually meet during the first week in March, convened in Buffalo, New York, Cleveland, Allentown, Pa., and other industrial centers this year and their deliberations will result in new purchase specifications, standardized tests, and emergency actions on specifications. A number of the committees discussed data from extensive research programs, according to R. E. Hess, assistant secretary of the society, and the material developed will appear in their annual reports.

Insulator Specifications

The committee on electrical insulating materials (D-9) met in New York City March 4 and 5, as did the committee on plastics (D-20). Five new specifications were approved for submission to letter ballot and the society for publication, and a number of important changes in standards were acted upon.

A number of members of the committee participated in the development by the Edison Electric Institute of the insulator specifications which cover low and medium-voltage pin-type line-glass insulators for mounting on wooden pins or on steel pins equipped with a lead or wooden cob, and metal-bushed lime-glass insulators for mounting on steel or hard-metal threads; both insulator types having a dry flashover of 85,000 volts or less. The committee approved these specifications.

Insulating Oils

In order to clarify the scope of the standard giving tests on insulating oils (D 117), the title is to be changed to incorporate the term "liquid mineral oils," it was announced. This standard does not cover synthetic materials. The test for neutralization number is important, it was pointed out, and another committee on petroleum products and lubricants (D-2) has recently perfected a new test for this property, using the color-indicator titration (D 663-42T). This will be made mandatory in the D 117 methods, but another test for neutralization number by electrometric titration (D 664-42 T) may be set up as permissible. The committee plans also to modify the mineral oil test standard so that color-indicator titration tests for saponification (D 94-42 T) can be used.

Rubber Insulation for Cable

The committee on specifications and tests for rubber products (D-11) met in Buffalo and, as usual, there was considerable activity in the field of rubber-insulated wire and cable. An emergency alternative provision has been effective for almost a year in the specifications for rubber sheath compound for electrical insulated cords and cables (D 532-39 T), setting up considerably less rigorous physical requirements. Some further modifications are to be made and the latest provision which is now in course of approval will provide that Section 2 of the specifications, requiring the vulcanized rubber sheet to be homogeneous in character, tough and elastic, and vulcanized in a metal mold, be eliminated.

Two important proposed new tentative specifications for synthetic jackets for wire, both involving the use of neoprene—one for light service, the other for heavy duty—have been drafted and submitted to the committee for vote. This is the first definite action of the committee involving synthetic rubber wire insulation. The same subcommittee—V on Wire and Cable—is voting on a new specification for polyvinyl chloride type of insulation and is actively working on G.R.S. (government rubber of synthetic type) for jackets and insulation; also, other synthetics are under consideration.

Coal Analysis Revision

The committee on coal and coke (D-5), which also met in Buffalo, recommended for adoption as standard, with some revisions, the present tentative revision of Sections 27-31 of the standard methods of laboratory sampling and analysis of coal and coke. This is a revision of the method for determination of fusibility of ash. Also, it was decided to add a new section calling attention to the fact that coal samples on standing, oxidize and change in composition, so that it is essential that they be analyzed as soon as possible after collecting the gross samples. Elapse of time between sampling and analysis should not exceed 30 days, it was agreed, if the B.t.u. determination is an important consideration.

The committee on magnetic properties (A-6) gave consideration, among other things, to the co-ordination and extension of test methods for electrical sheet and strip materials under alternating-current and direct-current magnetization, with the ultimate object of using a single lightweight specimen and test frame for all types of test.

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Probe REA Tie with Co-op Association

Rep. Dirksen calls Ellis and Slattery before subcommittee meeting

The subcommittee on agriculture of the House appropriations committee has become the sounding board for an investigation into the extent to which top administrative officials of REA have encouraged the organization and expansion of the National Rural Electric Co-operative Association.

The investigation is being pressed by Rep. Everett M. Dirksen, Illinois Republican, who has been at odds with REA's topside for the past two years. As a result of the latest flare-up, Dirksen called NRECA General Manager Clyde Ellis and REA Administrator Harry Slattery to testify before the subcommittee early this week.

Dirksen refused to comment on the testimony of either witness, pointing out that one of his complaints against Ellis, former Congressman from Arkansas, was that he claimed to have knowledge of testimony given the subcommittee in secret relative to REA's appropriation for the forthcoming fiscal year. However, in a statement inserted recently in the Congressional Record, Dirksen promised to attempt to determine whether: (1) Ellis' salary is $12,000 a year. (2) REA officials were connected with the founding of NRECA. (3) REA officials urged NRECA to invade the insurance business in Illinois and Arkansas. (4) Administrator Slattery was "identified" with NRECA and whether the association "was receiving his support."

Dirksen said he quizzed Ellis this week during his appearance before the subcommittee on charges made by the latter in a speech at Peoria, Ill., March 4 before the Illinois Association of Electric Co-operatives. A Peoria newspaper quoted Ellis to the effect that the life of REA was threatened and that the agency had been "attacked viciously" before the House appropriations subcommittee by Dirksen, in whose district Peoria is located.

SEC Opinion Rules Out Abuses of Holding Co. Act

In Columbia Gas & Electric case commission lays down principles governing service companies and their relation to holding companies and operating subsidiaries to abolish indirect levies

In an important decision and order approving company-proposed changes in the relationship of Columbia Gas & Electric Corp. and its servicing subsidiary, Columbia Engineering Corp., the Securities and Exchange Commission last week laid down a set of broad principles governing the relationship of service companies to their holding company parents and operating subsidiaries.

The decision itself separates Columbia Engineering Corp. from the parent holding company narrows its activities to services of a purely operating nature, and denies it any future participation in managerial, executive or policy-making power over the operating company. Changes in the servicing arrangements, the commission said, will save the operating subsidiaries of Columbia Gas & Electric an estimated $475,000 a year, or more than 35 percent of the aggregate servicing charges previously made.

Cites Indirect Levies

In its broader aspects, the commission's decision in the Columbia case, similar to that handed down in the case of Ebasco Services, Inc., the servicing subsidiary of Electric Bond & Share Co., which was upheld by the Supreme Court, aims at meeting the objectives of Section 13 of the Holding Company Act. That section strictly prohibits the levying of holding company expenses upon operating companies, through the medium of the service company. This practice, while prohibited by the act, the commission said, has been carried on indirectly through such devices as treasurer's or agent's accounts, split-check systems and other devious means to circumvent the law and eliminate the payment by holding companies of its own expenses, including officer's salaries.

Principles Laid Down

From their experience with a number of cases over the past few years, the commission said, "we have now accumulated a sufficient experience to warrant a general statement of the principles involved." The principles which the commission laid down are as follows:

"1. No operating company should be charged or have allocated to it, directly or through the medium of a service company or by any other arrangement, including treasurer's or agent's account, split-check system, or other devices, any portion of the salaries or expenses of any person or persons who are holding company officers or employees, or whose functions relate primarily to the functions of supervision of the holding company system and review of the activities of operating companies, their officials and staffs.

"2. A corollary to the above principle is that no holding company officer or person or persons whose functions relate primarily to the holding company functions of supervision of the holding company system and review of the activities of operating companies, their officials and staffs, should receive any compensation or reimbursement of expenses from any operating company directly or through a service company or any other arrangement including treasurer's or agent's account and split-check systems.

"3. Each service company should confine itself to functions which the operating subsidiaries cannot perform as efficiently and economically themselves. These services should be limited to services of an 'operating nature' as distinguished from managerial, executive or policy-forming functions."

•

San Diego Customer Education Plan

OCD Women Help to Schedule Courses on Appliance Care

Educating the public in wartime on the proper care and use of electrical appliances, meter reading, fuse changing and even minor repairs to electrical home equipment to help cut down on service calls has been handled in different ways in different localities. In San Diego, Cal., an original approach to the problem has been worked out, however, through the help of OCD "block plan" leaders, in co-operation with the Bureau of Radio and Electrical Appliances and the San Diego Gas & Electric Co.

Salient features of the program, summarized fully in a special edition of the

SAN DIEGO EDUCATORS—The three leaders in the San Diego drive to teach the public about the proper care and use of their appliances and wiring are shown above. Left to right, L. M. Klauber, vice-president and general manager of the San Diego Gas & Electric Co.; Mrs. David A. Fraser, chairman, Women's Division, San Diego Civilian Defense Council and J. Clark Chamberlain, secretary-manager Bureau of Radio and Electrical Appliances, under whose sponsorship the plan was developed

National Adequate Wiring Bureau's "Reporter," include the following points:

(1) An instruction course of four lectures in electrical home maintenance. (2) Distribution of 50,000 copies of an illustrated 64-page booklet, entitled "War-Timely Guide," through the agency of 4,000 women "block leaders," under the direction of Mrs. David A. Fraser, chairman of the Women's Division of the San Diego Defense Council. (3) A home survey conducted by the San Diego Gas & Electric Co., supplementing the educational work being conducted through the lectures. (4) Radio broadcasts to housewives on the subject.

The "block plan" is a citizens' voluntary co-operative activity and the work of scheduling the lectures, distributing the booklets, helping form neighborhood classes, etc., is under the direction of the block leaders. More than 100 of the lectures have been given to date, according to J. Clark Chamberlain, secretary-manager of the bureau.

•

NRPB Post-war Plan Urges "Grid" System

The National Resources Planning Board report for a post-war plan and program, sent to Congress last week by the President, contains little that is new in the utility field, but recommends again most of the steps which have become accepted as New Deal objectives.

Notable in this report is the board's suggestion that mixed public-private corporations be considered as possible vehicles for carrying out portions of its program, in power and other fields. Such groups, it is suggested, could be utilized to finance and operate the regional and national high-capacity transmission "grids" which are again advanced by the agency. The board's idea is that all such public-private corporation "hybrids" would be dominated by the government.

The report reiterates what previous board reports have urged in the way of continued, and enlarged, development of hydro resources on a regional basis, and of expanded rural electrification. It also urges again a unified national policy and plan for electric power built around the "grid" system.

President Roosevelt sent the report to Congress as a basis for discussion of post-war problems, not as a recommendation for legislation. Congress, however, recently cut off the planning board from 1944 fiscal year appropriations in a vote of "no confidence" in the agency.

Federal Agencies Tax Passed in Georgia

A bill to tax federal agencies competing with private enterprise in Georgia on the same scale as private business is assessed was passed unanimously this week.

House Speaker Roy V. Harris took the floor to support the measure offered by Representative T. Guy Connell of Valdosta. Mr. Harris warned that encroachment of federal agencies into various fields, especially public utilities, would so deplete state, county and city revenues that "we will have to go to Washington with our hats in our hands dependent on federal bureaucracies."

The speaker said the bill was prompted by a conversation he heard in which it was said the Federal Power Commission had offered a license to the Georgia Power Co. with the stipulation that the government could take over power company holdings in Georgia at any time, on payment of the market value of the holdings.

"The company refused to agree," he told the House, "and is preparing for a court fight over the matter. If the government should take over all power company holdings in Georgia some counties and cities would be ruined financially if those properties were written off the tax books."

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MEETINGS

Edison Electric Institute—Spring conference of utility accountants; AGA-EEI, Netherland Plaza Hotel, Cincinnati, Ohio, April 27-28; general commercial meetings, Edgewater Beach Hotel, Chicago, Ill., April 28-29; technical committee meetings, Edgewater Beach Hotel, Chicago, Ill., week of May 10. Col. H. S. Bennion, managing director, 420 Lexington Ave., New York, N. Y.

Previously Listed

Oklahoma Utilities Association — Conference of executives and department heads of member companies, Tulsa Hotel, Tulsa, Okla., March 22, Miss Kate A. Niblack, secretary, 625 Biltmore Hotel, Oklahoma City, Okla.

Southeastern Electric Exchange—Engineering and Operation Section, Henry Grady Hotel, Atlanta, Ga., March 25-26, J. W. Talley, executive secretary, 303 Haas-Howell Bldg., Atlanta, Ga.

Electrochemical Society — Spring meeting, Hotel Roosevelt, Pittsburgh, Pa., April 7-10. Colin G. Fink, secretary, Columbia University, 3000 Broadway, New York, N. Y.

American Institute of Electrical Engineers—Northeastern District, Wendell Hotel, Pittsfield, Mass., April 8-9; Southwestern District, Kansas City, Mo., April 28-30; National Technical Meeting, Cleveland, Ohio, June 21-25. H. H. Henline, national secretary, 33 W. 39th St., New York, N. Y.

Midwest Power Conference — Palmer House, Chicago, Ill., April 8-9. Stanton E. Winston, conference director, Illinois Institute of Technology, Chicago, Ill.

Illuminating Engineering Society — Southwestern regional conference, Baker Hotel, Dallas, Texas, April 9; P. M. Rutherford, Jr., regional vice-president, Dallas Power & Light Co., Dallas, Texas.

Missouri Association of Public Utilities—Annual business meeting, Elms Hotel, Excelsior Springs, Mo., April 16-17. Jesse Blythe, assistant secretary, 101 West High St., Jefferson City, Mo.

National Electrical Manufacturers Association — Spring meeting, Palmer House, Chicago, Ill., April 20-23. W. J. Donald, managing director, 155 East 44th St., New York, N. Y.

North Central Electrical Industries — Annual all-industry conference, Radison Hotel, Minneapolis, Minn., April 26-27. Wm. A. Ritt, secretary-manager, Foshay Tower, Minneapolis, Minn.

American Society of Mechanical Engineers — Spring meeting, Hotel Black Hawk, Davenport, Iowa, April 26-28; semi-annual meeting, Hotel Biltmore, Los Angeles, Calif., June 14-16. Ernest Hartford, executive assistant secretary, 29 West 39th St., New York, N. Y.

Missouri Valley Electric Association — Annual engineering conference to be held in conjunction with meeting of 7th District American Institute of Electrical Engineers, Continental Hotel, Kansas City, Mo., April 28-30. I. D. Pettegrew, director, 1527 Sharp Bldg., Lincoln, Neb.

Association of Iron and Steel Engineers—Spring conference, William Penn Hotel, Pittsburgh, Pa., May 10. Brent Wiley, managing director, Empire Bldg., Pittsburgh, Pa.

Arkansas Utilities Association — Annual convention, Marion Hotel, Little Rock, Ark., May 10-11. R. E. Ritchie, secretary, P. O. Box 551, Little Rock, Ark.

National Fire Protection Association — Annual meeting, Palmer House, Chicago, Ill., May 10-14. R. S. Moulton, technical secretary, 60 Batterymarch St., Boston, Mass.

National Electrical Wholesalers Association — War conference, Hotel Statler, Buffalo, N. Y., May 24-26. Alfred Byers, secretary, 165 Broadway, New York, N. Y.

REA Repayments $10,000,000 Ahead

REA borrowers were more than $10,000,000 "ahead of the sheriff" as of last January 1, the Agriculture Department reported recently. That sum had been repaid in advance of due dates, while delinquencies beyond 30 days were "few" and totaled only $234,942 on October 30, 1942.

While only 16 systems were old enough to be required to pay peak premiums, 267 systems reported earnings sufficiently high to make payments at top rates. Borrowers are allowed eight years before peak payments are required.

Interest and amortization payments due last October 30 totaled $26,370,287. Payments as of that date were $34,391,419. Advance payments spurted from $600,000 monthly in late fall to better than $1,000,000 in December, bringing total advance payments to more than $10,000,000.

Administrator Harry Slattery said the showing demonstrates the "financial stability as operating enterprises" of REA cooperatives.

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PUD Suit in Fifth Week

Suit of the Snohomish county (Wash.) PUD to acquire through condemnation the distribution properties of the Puget Sound Power & Light Co., is entering its fifth week in Seattle federal court, with testimony by J. A. Farrell, appraisal engineer from Ann Arbor, Mich., who has made a survey.

Mr. Farrell estimated the cost of reproducing the system of the company in Snohomish County at $6,116,514.

Electric Output Advances 17.5%

The output curve for the week ended March 13 dipped slightly below the point reached for the preceding week. The amount of electrical energy distributed by the light and power industry for the week totaled 3,944,679,000 kw.-hr., compared with 3,946,630,000 kw.-hr. distributed in the week ended March 6, and with 3,892,796,000 kw.-hr. for the week ended February 27. Figures for the latest week bring the percentage of increase nationally, over the corresponding week in 1942, to 17.5 percent, according to the Edison Electric Institute.

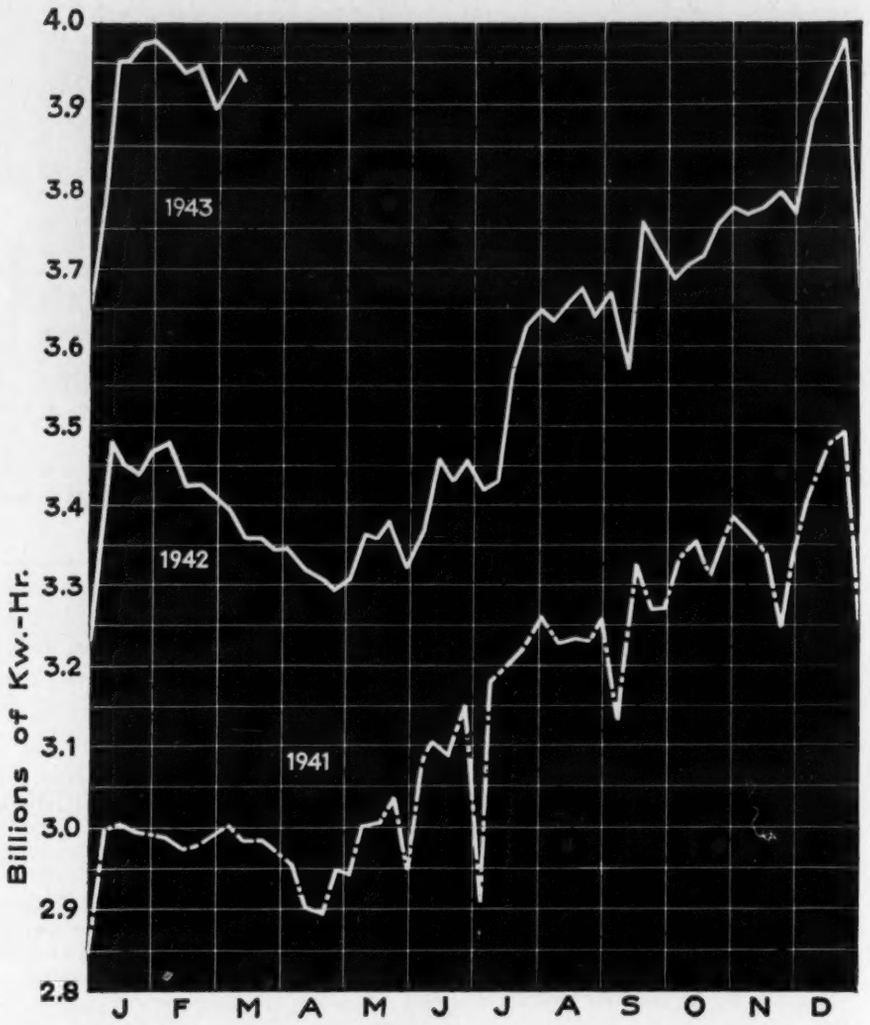
The report issued by the Institute showed that the Pacific Coast region with 25.8 percent increase over last year still leads the country in output gains, followed by the Southern states with 24.1 percent increase. All the other regions of the country improved their gains, registered the previous week. For the week ended March 13, New England reported a gain of 7.7 percent; for the preceding week, 3.6 percent.

Weekly Output, Millions Kw.-Hr.

1943		1942		1941	
Mar. 13	3,945	Mar. 14	3,357	Mar. 15	2,983
Mar. 6	3,947	Mar. 7	3,392	Mar. 8	3,005
Feb. 27	3,893	Feb. 28	3,410	Mar. 1	2,993
Feb. 20	3,949	Feb. 21	3,423	Feb. 22	2,985
Feb. 13	3,940	Feb. 14	3,422	Feb. 15	2,976
Feb. 6	3,960	Feb. 7	3,475	Feb. 8	2,589
Jan. 30	3,977	Jan. 31	3,468	Feb. 1	2,994
Jan. 23	3,974	Jan. 24	3,440	Jan. 25	2,996
Jan. 16	3,952	Jan. 17	3,450	Jan. 18	3,013
Jan. 9	3,952	Jan. 10	3,472	Jan. 11	3,002

Percent Change from Previous Year

	Week Ending		
	March 13	March 6	Feb. 27
New England	+7.7	+3.6	+4.5
Mid-Atlantic	+11.7	+11.3	+8.4
Central Industrial	+16.2	+15.0	+11.8
West Central	+16.2	+14.4	+12.8
Southern States	+24.1	+20.1	+17.7
Rocky Mountain	+13.1	+11.9	+9.4
Pacific Coast	+25.8	+30.6	+31.0
Total United States	+17.5	+16.3	+14.2



Upstate N. Y. Power Shortage Reported

So far as the metropolitan district of New York City is concerned no power shortage is imminent in the near future, but the up-state power situation, particularly in the Buffalo-Niagara Falls territory, is quite a different picture, according to the annual report of the Public Service Commission recently submitted to Governor Dewey by Milo R. Maltbie, chairman.

A survey concluded by commission engineers in 1942, the report said, showed that utility plants in the New York City area had an estimated surplus generating capacity ranging from 300,000 to 700,000 kw. that could be made available to other areas if adequate transmission lines were provided. In the vital Buffalo war industry zone, on the other hand, no appreciable surplus capacity over and above the 1942 regional demands was found to exist. The whole situation was set forth in the report by George E. Goldthwaite, consulting engineer, and R. H. Nexsen, the commission's chief power engineer.

Generating capacity at the time the survey was made, late in 1941, would be about sufficient to take care of 1942 demands, it was estimated, exclusive of a government aluminum plant. The supply to this plant, it was pointed out, would be dependent largely on increased transmission facilities from New York City, which could best be accomplished by reinforcement of existing privately owned facilities, rather than the construction of a new government line. For the purposes of aluminum production, the decision to erect a plant in the New York City area is in line with opinions in the commission survey.

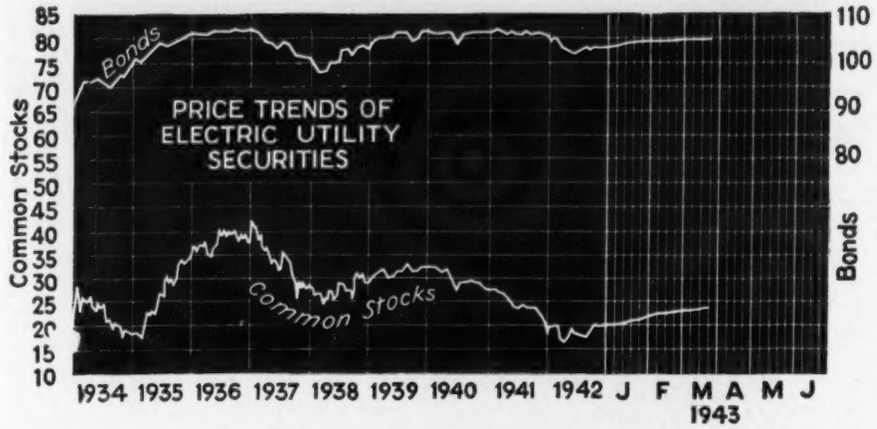
"Brownout" Conference Held in Washington

Nearly twoscore representatives of public and private utility systems from all parts of the country met with Director War Utilities J. A. Krug on March 11 to discuss the most practical means of putting into effect and administering a non-essential lighting "brownout" if such a step is decided upon as a fuel and transportation conservation measure by the government.

Discussion was informal and it was agreed by OWU that further consultation with the industry would be had if and when the "brownout" is decided upon.

Among the many questions that appeared on the agenda for this preliminary meeting included minimum show window and identification lighting, policing, etc.

Utility Securities Move in Narrow Range



There were few changes in prices of electric light and power stocks and bonds the past week. The "Electrical World" stock index gained 0.2 point, reaching 23.5; last year, 17.8. Bonds remained at 105.1; last year, 102.4

N.E.G.E.A. Loses Plea to Stay SEC Orders

The Securities and Exchange Commission in February denied a motion filed by the New England Gas & Electric Association to stay the issuance of any pending order of the commission, under "death sentence" provisions of the Holding Company Act, and reopen proceedings under Section 11(b)(2) of the act because new issues had arisen. At the same time it set a date for a hearing on the matter which involved two court claims against the holding company.

Having heard oral argument in regard to the motion, the commission last week issued its opinion on the matter, reaffirmed its denial of the motion and set April 5 for a reconvening of the hearing on the original order of February 19.

•

Nepsco Merger Plan Filed with SEC

New England Public Service Co. and three subsidiaries have filed a new plan with the Securities and Exchange Commission which proposes the sale by Twin State Gas & Electric Co. of its properties in New Hampshire and Maine to the Public Service Co. of New Hampshire for $4,048,977 in cash, and the merger of Twin State into Central Vermont Public Service Co. Prior to the proposed transactions, Twin State will sell its distribution system in New York State to New York Power & Light Corp.

A similar plan was filed several months ago by the same companies, but was withdrawn on March 3 except for a $20,000,000 refunding program by Public Service Co. of New Hampshire.

•

SEC Approves Sale of Arizona Utilities

The Securities and Exchange Commission last week approved the application of Southwestern Public Service Co. to sell two of its wholly owned subsidiaries—Arizona Electric Power Co. and Flagstaff Electric Light Co.—to James C. Tucker, for a base price of $775,000.

The sale represents one of Southwestern's steps to bring itself into conformity with Section 11 (b) (1) of the Holding Company Act, in line with a comprehensive plan filed with the commission and approved by it on July 8, 1942.

Utility Reports

	Net Income 1942	1941
*American Gas & Electric and subs	†$11,616,925	$13,887,905
*Appalachian Electric Pwr.	4,925,603	6,389,488
*Central Hudson Gas & Elec.	1,397,223	1,463,928
*Connecticut Light & Pwr.	3,586,506	3,752,340
*Gulf States Utilities	†1,703,170	1,903,620
*Houston Ltg. & Power	†2,841,568	2,922,279
*Illinois Iowa Power	2,979,769	2,802,150
*Kansas City Pwr. & Light	2,868,554	3,356,762
*Louisville Gas & Electric	†2,793,999	2,758,893
*Niagara Hudson Power and subs	5,250,933	8,712,370
*Oklahoma Gas & Electric	†2,365,244	2,389,687
*Philadelphia Elec. and subs	16,496,672	18,692,241
*Puget Sound Pwr. & Light and subs	†3,325,989	2,596,597
*Superior Water, Lt. & Pwr.	†159,924	91,040
*Washington Water Power and sub	†2,389,459	1,913,679

* Twelve months ended December 31.
† Preliminary.

FINANCIAL BRIEFS

THE SEC HAS TAKEN under advisement the proposal of Commonwealth & Southern Corp. to reduce the stated value of its $6 cumulative preferred stock from $100 to $10 per share in order to facilitate the payment of dividends on the preferred issue. The corporation suspended dividends in May, 1942, prior to which it had been paying 75 cents quarterly against arrears. In a similar case, involving United Corp., the commission granted the application.

WEST TEXAS UTILITIES CO. has proposed to the SEC that it purchase a maximum of 14,251 shares of its own $6 cumulative preferred stock from the American Public Service Co. for $70.17 a share. The latter company would then be able to acquire 10,000 shares of the 5 percent preferred stock of Public Service Co. of Oklahoma under a plan previously filed with the commission. Both companies are subsidiaries of Middle West Corp. American's purpose in the transactions, the company said, was to assist in the dissolution of Southwestern Light & Power Co.

ELECTRIC BOND & SHARE CO's proposal to use $15,000,000 treasury cash for open market purchases of its own preferred stock will receive SEC hearing on March 29.

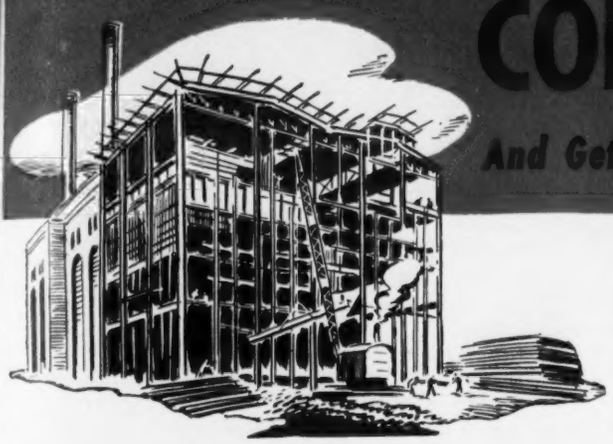
UTILITY SERVICE CO., wholly owned subsidiary of Manufacturers Trust Co. of New York, has filed a plan with the SEC providing for its own dissolution. The company proposes to accept from Manufacturers Trust, for cancellation and retirement, its demand notes in principal amount of $1,218,000, the notes to be surrendered as a capital contribution. Utility will then convey to the parent all remaining assets and will acquire and retire all its outstanding stock. March 24 has been set for hearing.

DIRECTORS OF NORTH AMERICAN CO. have authorized for redemption on April 15, at 102 plus accrued interest, $3,000,000 more of the company's outstanding 3¾ percent debentures of 1954. After this redemption, the company will have retired $34,012,000 of its debenture indebtedness over the last two years since April 15, 1941, reducing the amount outstanding by 48.6 percent to $35,988,000 from $70,000,000.

MORE CANADIAN POWER COMPANY 1942 earnings: Saguenay Power Co., Ltd., $1,422,857 in 1942, compared to $1,401,450 in 1941; Ottawa Light, Heat & Power Co., $217,070 in 1942, compared to $149,615 in 1941.

HOW WAR PLANTS ARE SAVING COPPER AND TIME

And Getting BETTER Electric Power Systems



EXPANDING war plants today must get power systems quickly—and yet *save* copper and other materials. Application of the methods outlined here will accomplish both these results—and *also* provide a better-than-ever system. Here's how it is done—

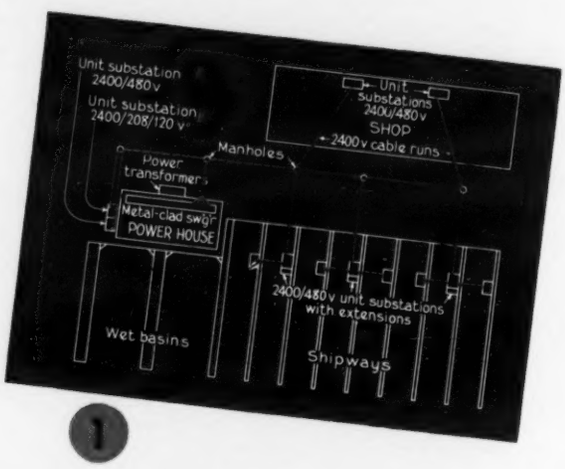
By Using Load-center Distribution

You can avoid long runs of heavy-copper secondaries by running the highest practical voltage direct to relatively small-size unit substations at the *centers* of the load areas, and save tons of cable copper.

Installing substations at the *centers* rather than at the sides of square load areas requires 30 to 40 per cent less copper.

By using four small substations rather than one large substation to serve a square load area, you need only half as much cable copper.

This is both practical and economical with modern safety-enclosed load-center units. These units, consisting of *Pyranol* transformers and *metal-enclosed* switchgear, can be safely installed right in working areas. Bulky, expensive vaults are unnecessary.

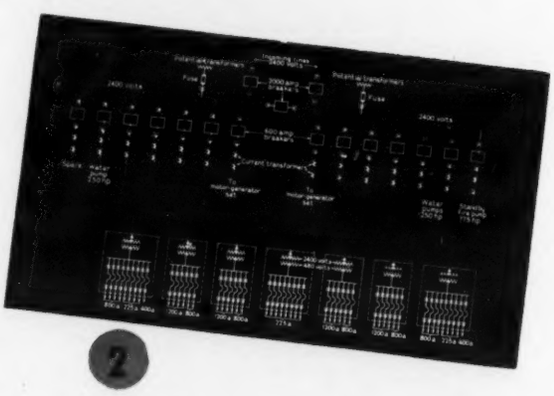


1

High-voltage is run directly to unit substations at *load centers*.

. . . And by Ordering *STANDARD SAFETY-ENCLOSED* Equipment *EARLY*

Standard means quick, easy selection and ordering. Safety-enclosed means an exceedingly high degree of flexibility as to location. Together, these advantages enable engineers to provide power in time to meet today's stepped-up schedules.



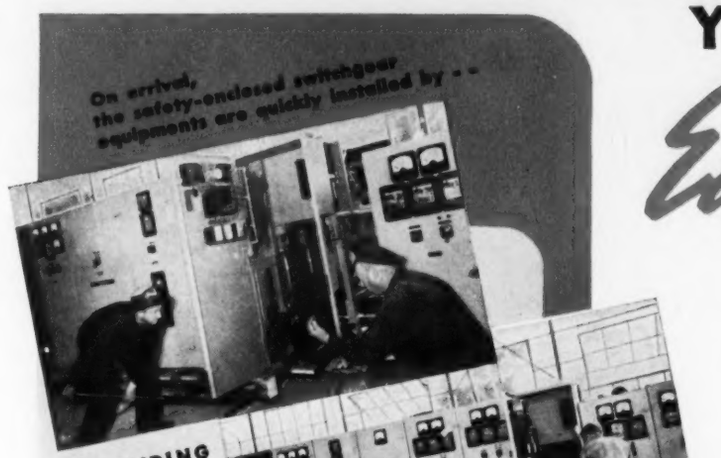
2

A simple one-line diagram is all that is needed for selection and ordering *standard* load-center unit substations and switchgear. This can be done when the plant or extension is in the first stage of construction.

Do This And . . .

GENERAL ELECTRIC

. . . THEN YOU CAN INSTALL YOUR POWER SYSTEM *Early and Easily*

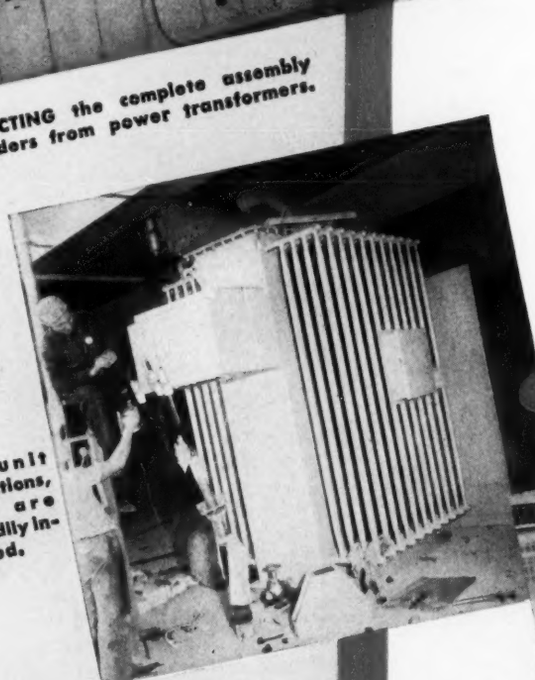


On arrival, the safety-enclosed switchgear equipments are quickly installed by . .

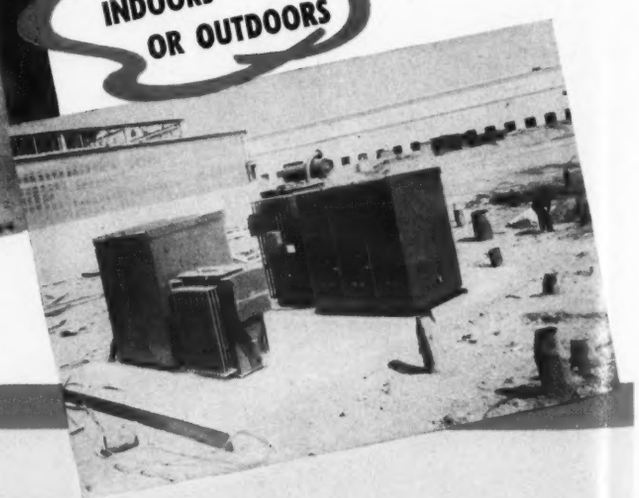
3 SLIDING the units into their final position.

4 JACKING them down onto their sills, using a jack at each corner.

5 CONNECTING the complete assembly to feeders from power transformers.



6 The unit substations, too, are speedily installed.



Safety-enclosed switchgear and load-center unit substations are completely factory-assembled, and are shipped in compact, easy-to-handle units that arrive all ready to be set in place and connected.

THE SAFETY-ENCLOSED SWITCHGEAR CAN BE QUICKLY INSTALLED simply by a "slide, jack, and connect" operation, as shown at the left. Each equipment is a safe, co-ordinated, unit assembly including circuit breakers, buses, and all associated equipment.

Because these compact units dependably perform any desired combination of functions, they save you the extra time and materials needed to select and install open-type exposed switchgear which necessitates long, wasteful copper interconnections.

YOU CAN PUT IN THE UNIT SUBS JUST AS QUICKLY—INDOORS OR OUT. On arrival, the transformer and switchgear sections of the unit substation are moved into position and bolted together. Connections are made to the incoming and outgoing circuits, and the unit substation is ready for service. Flexibility as to location of these safety-enclosed units is such that you can put them right at the load centers. In fact, they can usually be put in relatively valueless space—along column centers, on sub-balconies, and over washrooms.

GENERAL ELECTRIC

EARLY INSTALLATION SPEEDS THE REMAINING CONSTRUCTION WORK——

Compact, standard unit substations —ordered early and installed the flexible, load-center way—have gone into service in scores of new or enlarged war plants weeks before construction was completed. In this way a ready, dependable supply of power is made available for all the power-driven tools and equipment needed to complete the construction. This eliminates the job of improvising a "temporary" power system that often presents a hazard to workers and is subject to power interruptions. It also eliminates a later change-over to the permanent system.

——AND GETS PRODUCTION MACHINES ROLLING AS SOON AS POSSIBLE

Production machines need not stand idle waiting for an electric power system that couldn't be ordered until the building and the exact load locations "took shape." The flexible load-center system easily follows last-minute rearrangement of the machines, and can safely be ordered in time to arrive when needed.

From the very start, you get full protection for both production and personnel. The primary feeders are controlled and protected by metal-clad switchgear equipments so safe that workers can be located near them. Low-voltage feeders from the load-center unit substations are likewise protected by metal-enclosed drawout-breaker equipments that form an integral part of the unit substation.

In this new war plant—

7 The power system was installed in time for electric cranes to do much of the remaining heavy work during construction, and during installation of machines.

8 Load-center unit substations were ready to supply power for production machines, without delay.

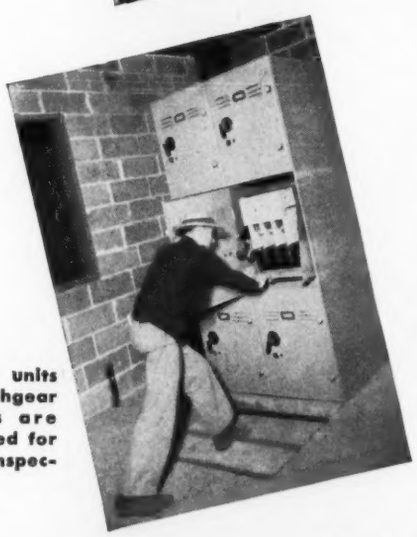
9 Metal-enclosed switchgear equipments were in service to control and protect all feeders to the unit substations, motor-generator sets, and pumps.

Now—ADD UP THE ADVANTAGES

Packaged load-center unit substations GIVE YOU THESE ALL-IMPORTANT SAVINGS

10 **Many tons of copper are saved by distributing power at primary voltage right to safety-enclosed unit substations at load centers—and the complete, permanent electric power system can be installed in less than one-third the time required to select and install piecemeal equipment.**

11 **All units are safety-enclosed to assure permanent safety to both personnel and production.**



12 **The breaker units of all switchgear equipments are easily removed for quick, easy inspection.**

COPPER—When you replace heavy-copper secondaries with small-size primary cables, you save copper by the ton. Consider a 1000-kva, 4160/480-volt unit substation: For every foot that it is moved closer to the load center, you use 1.23 pounds of copper instead of 13.89 pounds. With many units and hundreds of feet, the copper savings soar.

You save copper within the units themselves, too. A typical unit of metal-clad switchgear uses only one-third the copper required by an open-type, piecemeal assembly for the same job.

TIME—In addition to the weeks you save by ordering safety-enclosed load-center units early, you save time by getting standards instead of specials—in a package instead of piecemeal. You avoid the preparation of detailed specifications, and long, drawn-out correspondence, when you select standard, co-ordinated units. You also save time installing the compact, easy-to-handle units.

THEY ARE IDEAL FOR TODAY - - AND FOR TOMORROW

SAFETY AND DEPENDABILITY—Metal-enclosure of all live parts gives increased protection to both personnel and continuous high production in today's busy factory areas.

EASY INSPECTION—Load-center unit substations include drawout-air-breaker equipments that control and protect the individual low-voltage feeder circuits, and quickly restore service with a turn of a handle. The individual breakers can be easily withdrawn for inspection. Similar breaker units are completely interchangeable, so any breaker can be replaced with a spare in a few minutes.

The higher-voltage, metal-clad switchgear equipments (photos 3, 4, and 5) have vertical-lift breaker units that are similarly easy to remove and to replace with a spare during periodic inspection.

FLEXIBILITY—Safety-enclosed load-center units "go anywhere the load can." Their compactness makes them easy to move, too—whether it be a few feet or miles. This flexibility is valued highly by many engineers who realize that they may want to move power units to follow shifting, changing loads.

GENERAL ELECTRIC

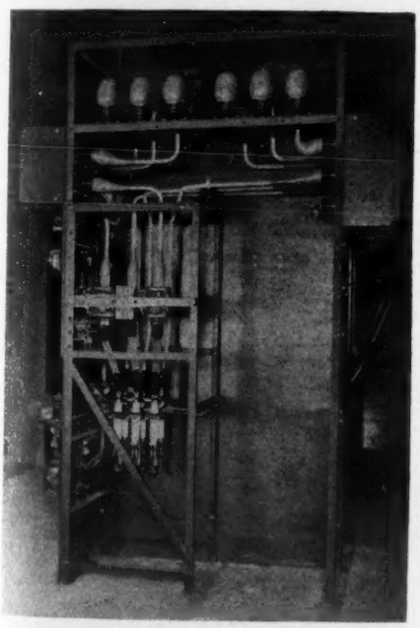
Schenectady, New York

HOW DESIGN . . . CONSTRUCT OPERATE MAINTAIN

Cubicle Layout Aids Regulator Removal

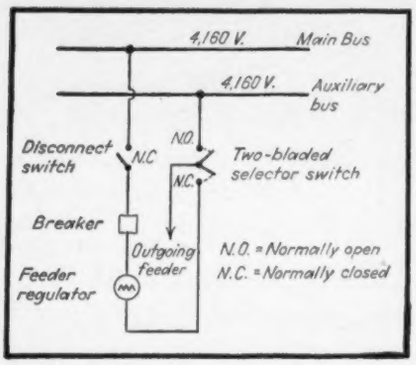
Accompanying illustrations show the arrangement of metal-clad switchgear cubicles used at the Phenie and Du Bois substations of the City Utilities, Fort Wayne, Ind. These cubicles, rebuilt from obsolete breaker units in the shops of the utility, provide convenient and flexible means for removing feeder breakers and regulators from service for routine inspection and maintenance.

Both a main and auxiliary 4,160-volt feeder bus is provided at the top of the cubicle. Taps for each feeder circuit are brought down through a disconnect switch, feeder-breaker and voltage regulator to a two-bladed selector switch that permits the feeder circuit to be supplied from either the main or auxiliary bus.



ARRANGEMENT of cubicle used to energize auxiliary bus during maintenance operation

Main bus is at top left, auxiliary bus top right. This cubicle was later converted to a feeder cubicle and connections from breaker to selector switch changed to conform to diagram.



AUXILIARY BUS carries feeder load during periodic breaker and regulator maintenance operations

In order to remove a feeder breaker or regulator from service, the regulator is placed on the neutral position and one of the two blades of each selector switch is operated to the upper position, connecting the feeder cable to the auxiliary bus, which has previously been energized from another source. While the selector switches are in this position the cable is fed from both the auxiliary bus and the feeder breaker. The second blade of each selector switch is then operated to the upper position, which transfers the entire load to the auxiliary bus. The regulator excitation current can then be interrupted by the feeder breaker.

One of the cubicles (see picture) was formerly arranged to energize the auxiliary bus during these operations. In this cubicle taps from the main bus pass through a disconnect switch and breaker to the center pole of the selector switch, permitting the top blade to be closed in to energize the auxiliary bus at will. However, with subsequent expansion this cubicle has been changed into a feeder cubicle. The auxiliary bus is now energized by closing both blades of one or more of the selector switches in adjacent cubicles, thus energizing the auxiliary bus from the main bus.

•

Aerial Cables Serve as Station Ties

The main generating station and the associated switch house of an Eastern utility is located on river flats in the center of the city, at a level approximately 90 ft. below the adjoining streets. When the switch house was constructed in 1926 the reinforced concrete duct structure (C in Fig. 1) was built to connect to the subway at the top of the hill. This conduit bank contains 36 ducts, an extremely undesirable number from the standpoint of accumulated heating and cost.

In 1942 system rearrangements necessitated the construction of an addition to the switch house and the installation of new tie line cables. To construct a conduit bank at the location available would have been very difficult because bedrock is very low at this point and there are no projecting rock ledges for intermediate support. It was, therefore, decided to install cables without a conduit system and two methods have been employed.

Four aerial cables are supported on Copperweld steel messengers anchored on mandrels in a manhole at the

FIG. 1—SIX aerial cables (four on messenger and two on ground) supplement old inadequate and overcrowded duct line

top of the bank and extended through the duct to the upper terminal pole on the slope outside the manhole wall. Each of two poles supports a pair of cables and the cable is clamped to the messenger at the upper end at three points down the slope to prevent creepage.

Two lines (A) are armored cable laid on the surface of the ground and anchored at the top of the hill (Fig. 2). This is three-conductor, round, 500,000 cir.mil with 15/64 in. of varnished cambric, 8/64 in. of lead, jute bedding and No. 4 galvanized steel armored wire.

Both the aerial and armored cables have been installed for several months, through a rather severe winter, and there has been no indication of slippage, sheath cutting or damage of any kind. The installation saved money, man-hours of labor and critical material.

Effect of Magnetic Heating on Cables

By W. H. BURLESON
Manager, Power Utilities Department, Ohio Brass Company, Mansfield

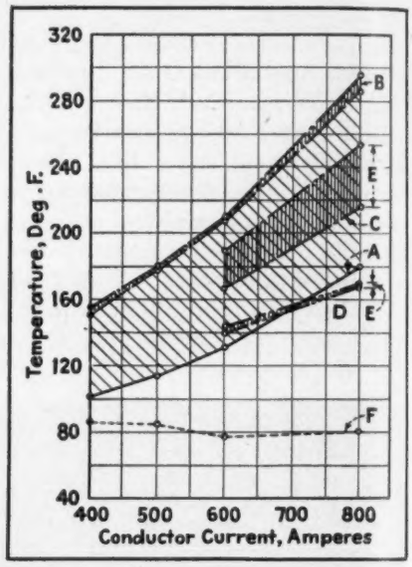
Numerous existing transmission and distribution lines can be loaded for wartime emergency to much higher current ratings than have been considered previous good practice.

Before the load is increased consideration should be given to the number and characteristics of current taps or splices and conductor supports on the line. Possible heating as the result of magnetic losses are important and should be considered first.

If existing lines not specifically engineered for currents above 200 amp., loading to 400, 500 and 600 amp. can cause localized concealed annealing at a great many places on the line. The anneal condition of the cables may not be evidenced for several years or until heavy storm loadings are encountered, then trouble reports are likely to include many conductor failures occurring near or within the clamp seat area or at splices or cable taps.

Studies have been made of the magnetic heating hazard in suspension and strain clamps used with conductors carrying high currents. From tests it is apparent that the magnetic heating of such clamps for currents in the order of 400 to 500 amp. may be from 50 to 250 percent greater than the temperature rise of the cable to which it is attached.

Results of a test on 500,000-cir.mil stranded copper cable, 1 in. O.D., commonly used on 220 kv., are shown in the accompanying chart. At 400 amp. or a current density of 0.0008 amp. per cir.mil, the conductor temperature rise as measured was only 16 deg. F., whereas the temperature of all-ferrous suspension or strain clamp assemblies was from 150 to 156 deg. F. or a rise attributable to the clamp from 48 to 54 deg., more than three



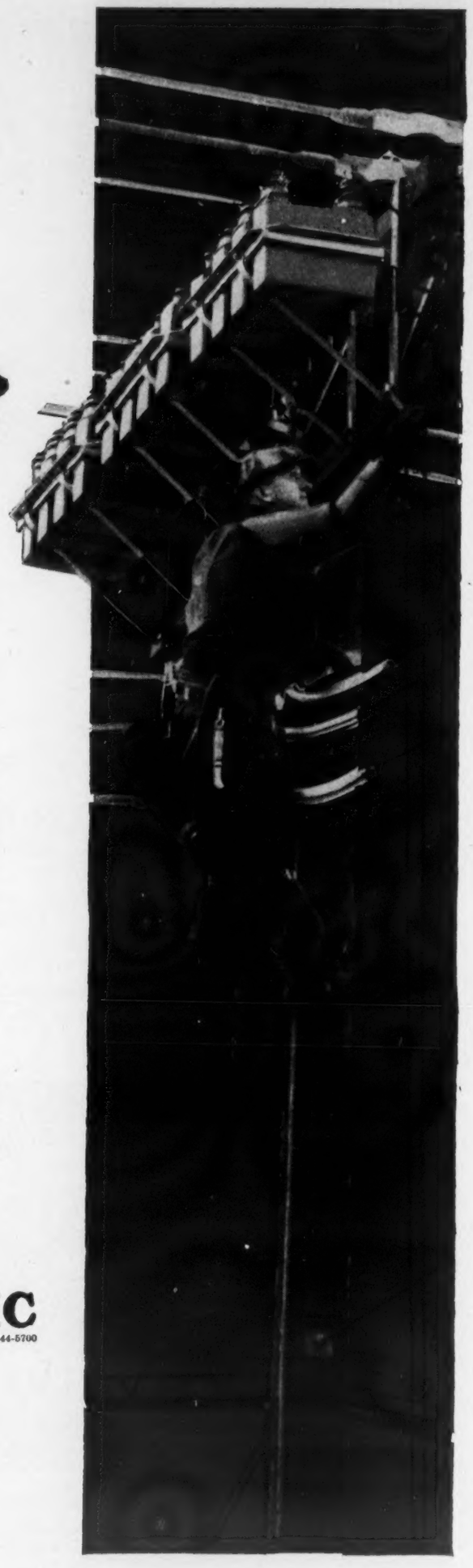
CURVES showing temperature observed on 1-in. O.D. 500,000-cir.mil cable and in all-ferrous clamp assemblies attached to same conductor when carrying indicated currents

A—for cable; B—for all-ferrous clamp assemblies; C—for clamp of ferrous body and keeper piece and non-ferrous U-bolts; D—for clamp of ferrous body and non-ferrous keeper piece and U-bolts; E—temperature range observed on several tests; F—room temperature at time of test.

FIG. 2—ARMORED WIRES clamped to hold cables at top of slope down to generating station

IN 3 HOURS

HE HAS CLEARED THE WIRES FOR MORE KILOWATTS!



COST? ABOUT $7 PER KVA...AND WITH BIG SAVINGS IN VITAL COPPER

DEPENDING on their power factor, circuits that are fully loaded can carry from 10 to 40 per cent more load after G-E Pyranol capacitors have been installed.

Capacitors for an entire distribution system can be obtained and installed in a matter of weeks; they require only a fraction of the critical materials you would use in the installation of new feeders or generating equipment.

Ask your G-E representative today for a preliminary estimate of the capacity increase that's possible with Pyranol capacitors. Or write for GEA-3333. General Electric, Schenectady, N. Y.

GENERAL ELECTRIC

407-44-5700

times the temperature rise in the conductor.

For currents of 600 and 800 deg. F. with conductor temperatures of 132 and 180 deg. F., respectively, temperatures of 167 and 216 deg. F. were measured on a clamp in which non-ferrous U-bolts had been substituted for the ferrous U-bolts. Rise in temperature attributable to magnetic heating of the clamp was 35 and 36 deg., respectively.

Non-Magnetic Material

It is apparent from the curve that if the magnetic heating attributable to the clamp is to be held within reasonable limits, both the keeper piece and the U-bolt should be of non-magnetic material. (Subject to restriction of Copper Conservation Order, M-9c.) Under this condition, at 600 amp. the total measured temperature was 141 deg. F. with a 9-deg. rise above cable temperature. At 800 amp. the clamp temperature was 168 deg. F. or a minus 12-deg. rise. From this latter data it would appear that the positive and negative degree rise might be attributable to test variations, as the negative 12 deg. is unexplainable at this time, but it may be safe to say that under most favorable conditions a variation in temperature as between cable and clamp may be plus or minus 10 percent.

All tests were conducted at 60 cycles. The frequency will, of course, have direct effect upon magnetic heating.

•

Siren Placed High by Two Winches

By WILLIAM FRIEDHOFF
General Superintendent
Municipal Electric Department, Elwood City, Pa.

Length of the pole derrick on the department's line truck was much too short to be able to lift a siren for the fire department to an elevated platform where it could be heard. This platform was set near the top of two 30-ft. poles. In order to reach this height the boom of the derrick was used to support a 45-ft. pole at about its middle. A second winch in conjunction with supplementary blocks at the upper end of the 45-ft. pole proved quite successful as an improvised rig for mounting the siren. Incidentally, the siren weighed about

FIRE SIREN lifted to elevated platform by means of 45-foot pole used as derrick extension.

400 lb.; if necessary, this same rig could probably be used to lift a transformer up to about 50 kva.

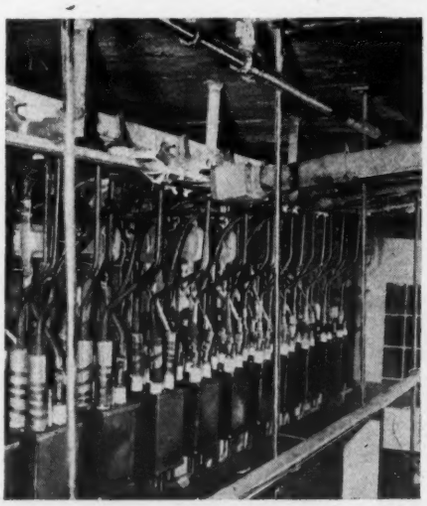
•

Sprinklers Serve Low-Voltage Mill "Sub"

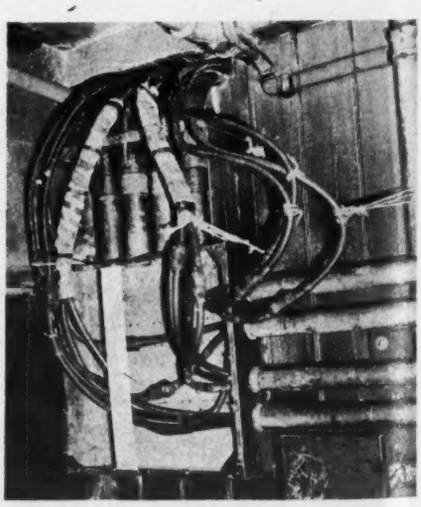
An Eastern textile mill running on purchased energy was handicapped by low-capacity substation circuit breakers difficult to replace under war conditions, although these breakers had been adequate at a former time when the mill generated its own electricity. With three transformers rated at 2,500 kva. total to receive energy from the power company, the mill realized the importance of providing fire protection for the switchboard and breakers at its rear and had installed twelve automatic sprinkler heads about 5 ft. above the breakers and immediately under the substation ceiling. The mill was insured with the Associated Factory Mutual Fire Insurance Companies, Boston.

A fire broke out in the mill picker room which short-circuited some 600-volt power cables serving the interior of the mill, and this opened an oil circuit breaker at the switchboard. A short time later a plant electrician, unaware of the burned picker room cables, closed the breaker, and a violent explosion immediately ruptured the breaker casing and showered burning oil over the switchboard equipment. No further electrical disturbance took place. The sprinklers opened and controlled the fire, which threatened to involve insulation on all the cables and oil in the other breakers.

Thanks to these sprinklers, damage to the switchboard and massed cables was confined to a small area, but the mill had to be shut down for 3.5 days with a loss of 150,000 man-hours of production. Without the sprinklers, recommended as a modernizing measure to safeguard substations in areas involving combustible building construction, the plant would have been shut down for one to three weeks. The temporary damage from water sprayed upon the 600-volt electrical equipment proved a minor item when compared with the saving of the board and breakers in a period when replacements are most difficult.



SPRINKLER INSTALLATION above oil circuit breaker tanks minimized fire damage to 600-volt switchboard

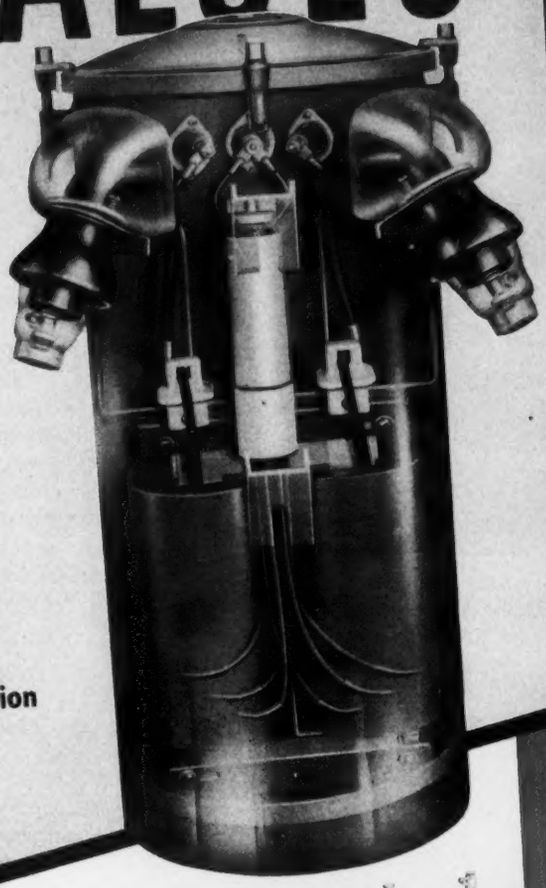


TEMPORARY JUMPER cables by-passed damaged section of cable and conduit to permit early restoration of service

PLUS VALUES

IN MOLONEY TRANSFORMERS

- ✓ Uniformly high impulse strength
- ✓ Winding vacuum-impregnated in compound
- ✓ Ratio adjusters supplied on transformers with taps
- ✓ Core-and-coil assembly anchored above oil level
- ✓ E. E. I.-NEMA Standard Construction



GET THESE MOLONEY PLUS VALUES FOR MORE ECONOMICAL OPERATION

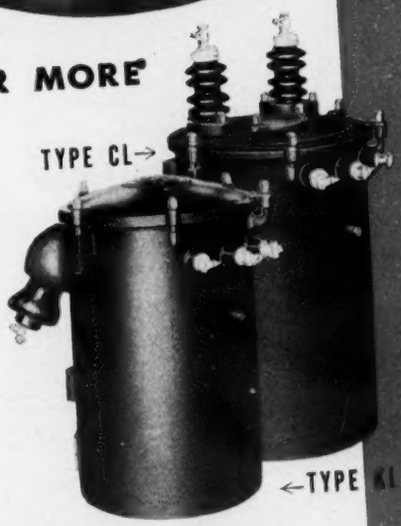
High impulse strength means greater resistance to surges. The uniformly high impulse strength of Moloney Transformers reduces the possibility of burnouts due to failure of lightning protective equipment.

Vacuum-impregnation of windings in compound eliminates moisture and air pockets, and provides additional mechanical strength to resist the effects of momentary short circuits.

Moloney ratio adjuster with operating handle located above the hot oil level saves time and trouble in changing taps. Core-and-coil units anchored above oil level make it convenient to remove the units for inspection or repair.

E. E. I.-NEMA Standardized Construction permits uniformity of installation design and simplifies the problem of transformer interchangeability. Moloney Type KL and Type CL transformers conform with these new standards. These are illustrated at right. Type KL has pocket-type high voltage bushings and Type CL has cover-type high voltage bushings.

Additional information regarding these transformers may be obtained by writing for Bulletin D-412.



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POWER AND DISTRIBUTION TRANSFORMERS EXCLUSIVELY SINCE 1896

HOW TO FIREPROOF LEAD-SHEATHED CABLE

By A. C. AVRIL, President Sackrete, Inc., and GEORGE LINEBACK, Chemist Cincinnati Gas & Electric Company

A standard practice for cable fireproofing by use of a special cement and sand mixture called "Cablekrete" has been adopted by the underground electric distribution construction department of the Cincinnati Gas & Electric Company. The adoption was made after fireproofing all cables in 35 manholes on a 16,000-ft. line and after periodic inspections carried on for two years. Steps in applying the mixture are illustrated.

Cable failures in underground installations in service from one to ten years could be traced to sheath deterioration. Cable fireproofed with common cement and sand mixtures showed varying degrees of sheath corrosion from free alkalis as products of cement hydration as well as alkalis and acids derived from atmospheric condensation and ground waters in manholes.

A patented fireproofing material was developed by combining selected ingredients to meet all of the necessary requirements.

The dried pre-mixed material when a proportionate amount of water is added has an adhesive value of about 200 grams per square inch. Also the mixture inhibits sheath corrosion. It reacts with the lead sheath to form a microscopic film of lead compounds on the sheath which are insoluble in the characteristic alkali and acid conditions usually found in manholes.

The fireproofing has refractory properties such that arcing temperatures do not cause the coating to crack or crumble. In addition it is not damaged by cable movement due to load or temperature variations, and after hardening is easy to remove without damaging the lead sheath so that cable repairs or splices can be made.

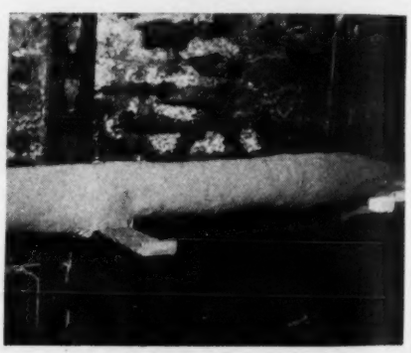
As to an economical application—the loss of material is less than 3 percent compared to a loss of more than 30 percent where plain cement and sand coatings are used. Man-hours of labor required for its application is less than half of the hours required to apply other types.

1 Fireproofing mixture applied to topside of cable

2 Complete coverage; underside joined to topside layer

3 Cheese cloth wrapped on mixture to provide reinforcement

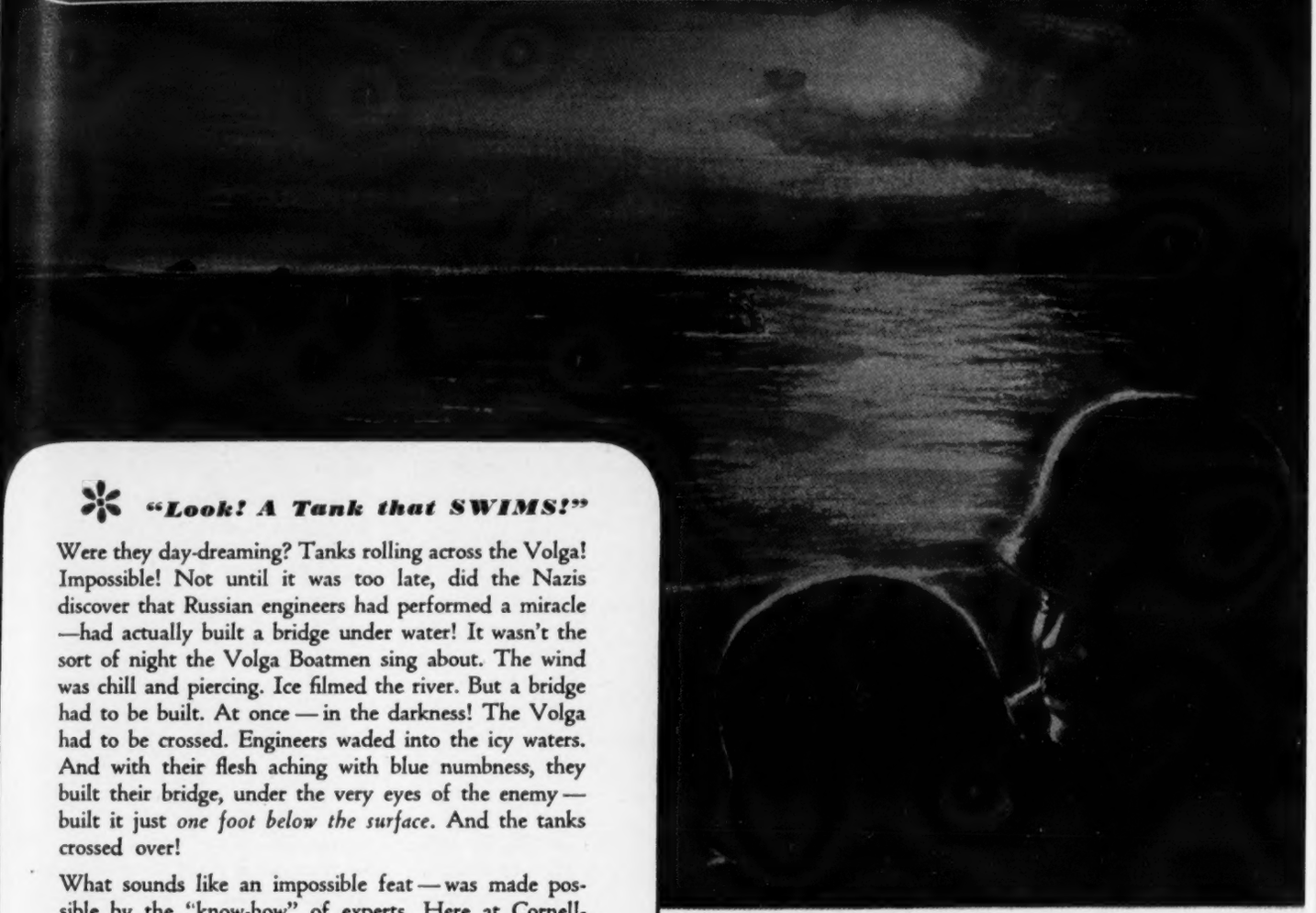
4 Forming operation to obtain symmetry of coating; the cheese cloth is thinly coated with Cablekrete



5 Completed coating on 2½-in. diameter cable

6 Fireproofing removed easily without damage to lead sheath

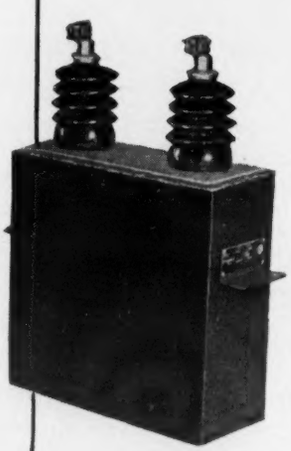
"Schau! Ein Tank, der Schwimmt!" *



* *"Look! A Tank that SWIMS!"*

Were they day-dreaming? Tanks rolling across the Volga! Impossible! Not until it was too late, did the Nazis discover that Russian engineers had performed a miracle —had actually built a bridge under water! It wasn't the sort of night the Volga Boatmen sing about. The wind was chill and piercing. Ice filmed the river. But a bridge had to be built. At once — in the darkness! The Volga had to be crossed. Engineers waded into the icy waters. And with their flesh aching with blue numbness, they built their bridge, under the very eyes of the enemy — built it just *one foot below the surface*. And the tanks crossed over!

What sounds like an impossible feat — was made possible by the "know-how" of experts. Here at Cornell-Dubilier we're not builders of bridges — not even in the daytime. But we do build capacitors — day *and* night. And these capacitors are built for conditions as extreme as those on that freezing night on the Volga. To some people, the unfailing durability we build into C-D Capacitors seems as amazing a feat as building bridges under icy rivers. But like all specialized jobs, it is a matter of "know-how" that makes the seemingly "impossible" possible. We have acquired this "know-how" through thirty-three years of specialized experience building capacitors — and capacitors only. Today this accumulated knowledge and experience, built into capacitors for power-factor improvement means just one thing — greater reliability in C-Ds. Investigate now, how C-Ds can increase your pay load capacity quickly and efficiently. Our engineers will be glad to consult with you. Cornell Dubilier Electric Corporation, South Plainfield, N. J.



Pole-Mounting C-D Capacitor

Illustrated is a 15 Kva., 2,400 Volt, single phase, 60 cycle, Dykanol, individual outdoor, capacitor Unit. Because of the compact construction and durability of these capacitor units they can be mounted singly or in multiple combination, on pole cross-arms. They are extensively used by leading systems and industrial plants for power-factor improvement at critical load points. For complete details write for Catalog No. 143C.

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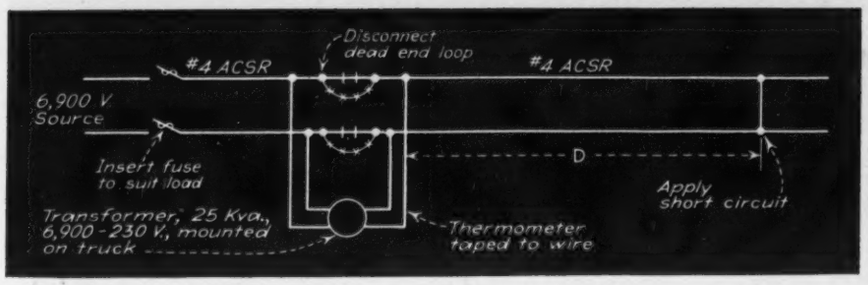
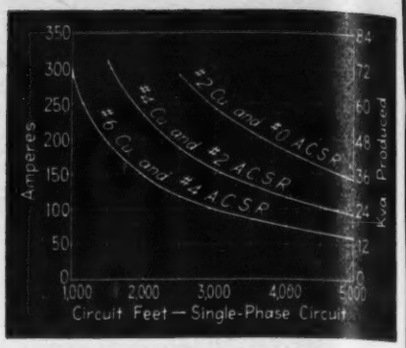
Cornell-Dubilier capacitors *for power-factor improvement*



LOW-VOLTAGE ENERGY applied to circuit length D melted ¾ in. of radial ice on conductors in 17 minutes under conditions listed in table



CURVES showing current flow and kva. input to be expected at 240 volts for various circuit lengths (single phase), sizes and types of conductor

Thawing Ice on Distribution Lines

By C. G. DARRAH

Engineering Department, Public Service Co. of New Hampshire, Manchester, N. H.

Preliminary ice-thawing tests on a 6.9-kv. single-phase circuit serving rural customers of the Public Service Company of New Hampshire were sufficiently successful this winter to establish a basis for future practice to protect distribution lines against possible collapse under heavy ice loading.

The ice-thawing scheme consists essentially of applying temporarily 240 volts a.c. to an opened section and short circuiting the phase wires at a predetermined distance from the source of energy. The source was a 25-kva. transformer mounted on a truck which was placed at a dead-end pole where the loop could be disconnected, and fuses rated above the expected load were located in the incoming 6.9-kv. supply line as shown. The circuit was of No. 4 ACSR conductor and of the long-span type.

To guide in the selection of distances practicable for the expected current requirements at 240 volts, a chart was made up showing the amperes which would flow at various circuit lengths or one-way distances in feet for No. 2 copper and No. 0 ACSR, No. 4 copper and No. 2 ACSR and No. 6 copper and No. 4 ACSR. The total wire length is double the circuit length.

Three tests were run, with the conditions as shown in the table. Ice thickness on conductors was about ¾ in., radial. In the first test, the circuit length tried was 2,811 ft. and no signs of melting occurred in 46 minutes. The current used, 117 amp., appeared inadequate. In the second test 1,964 ft. was tried, starting with 155 amp. Here signs of melting occurred, but after 53 minutes ice remained. The outdoor temperature was 8 deg. F. In the third test, which was very satisfactory, the distance was 1,455 ft., outdoor temperature 20 deg. in sun, and all ice was cleared in 17 minutes. It appeared that time could be saved in connecting up the equipment if an independent source of energy, say a 50-kw. generating unit, was available on the truck. Longer circuit distances could also be covered by supplying higher voltage currents to the line to be freed from ice, say of the order of 440 or 550 volts. With an independent source of energy on the truck a section on each side of the truck could be thawed with one set-up of the truck. In the low-voltage tests made, which were at Washington, N. H., it was not of course necessary to pull the fuses of the customers' transformers, and there were no adverse reactions to the opening of the line for ice melting. The fact that melting was a complete success in 17 minutes of application was noteworthy, and eight minutes was required to walk to the location of the short circuit and disconnect it.

Ice-Thawing Tests on 6.9-kv. Circuit Single-Phase, Rural Service, No. 4 ACSR

1ST TEST

Jan. 6, 1943. Air temperature 10 deg. F. "D" (Fig. 1) was 2,811 ft. Transformer secondary volts, 240 plus. No sun. Diameter over ice, 1¾ in. Radial ¾ in.

Time P. M.	Wire Temp. Deg. F.	Amp.	Remarks
			Thermometer on wire (held by tape) near truck
4:33	[illegible]	117	No sign of melting in 46 minutes
5:19	30	Not read	Apparently insufficient current

2ND TEST

Same location as above except "D" was 1,964 ft. Temperature at finish, 8 deg. F. No sun.

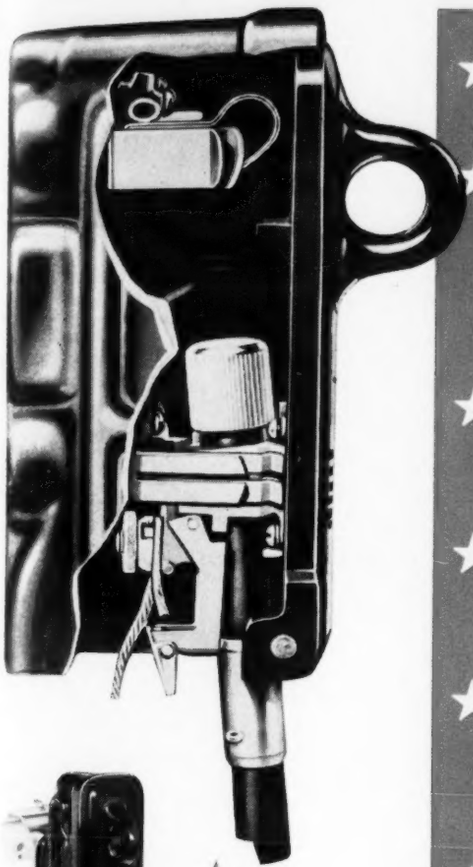
5:24	13	155	
5:33	54	155	
5:36		Not read	Small piece of ice fell off.
5:39	63	Not read	
5:45	66	Not read	
5:52	72	Not read	Noticed a few drops of water falling.
5:54	78	Not read	Noticed change in ice formation.
5:56	77	Not read	
6:03	80	Not read	Ice remained after 53 minutes.
6:09	85	Not read	A little more current or warmer air
6:17	85	Not read	temperature probably would have melted ice.

3RD TEST — Successful Results

Jan. 7, 1943. Air temperature 20 deg. F. in sun. "D" was 1,455 ft. Transformer secondary voltage before short circuit, 257; under short current, 240. Wind velocity estimated 10–12 m.p.h. Diameter over ice 1¾ in., or ¾ in. radial. Wire diameter ¼ in.

Time P. M.	Wire Temp. Deg. F.	Amp.	Volts	Remarks
12:49	20	187	240	
12:50	33	...	...	
12:51	50	184	...	
12:52	68	183	...	Water starts to drip
12:53	80	182	...	3-ft. piece of ice fell
12:54	88	181	...	Ice falling all along
12:55	90	180	...	Ice falling all along
12:56	92	178	...	Ice falling all along
12:57	93	177	...	Ice falling all along
12:58	96	175	...	Ice falling all along
12:59	98	173	...	Ice falling all along
1:00	100	172	239	Ice falling all along
1:01	100	170	...	Ice falling all along
1:02	...	...	...	Thermometer broke from falling
1:03	...	...	...	ice
1:04	...	...	...	
1:05	...	168	...	
1:06	...	168	239	Ice off, conductors clear entire length.
1:14	...	...	...	Short-circuit off. Eight minutes to cover distance and remove.

HERE ARE THE REASONS WHY YOU FIND THE L-M "PVD" FUSE CUTOUT ON SO MANY LINES



Only the L-M PVD has all these important features that you want in a modern fuse cutout. That is the reason why there are so many PVD's in use today.

FOUR SIZES

5000 V, 50 A — No. C-230016-6
7500/12500 V, 50 A — No. C-230004-6
5000 V, 100 A — No. C-230029-6
7500/12500 V, 100 A — No. C-230005-6

★ **always protected** The PVD door is always closed, internal parts are always protected from the elements.

★ **unfailing operation** Because the operation of the PVD is independent of any door movement and because all working parts are fully protected, the PVD operates as a disconnecting or dropout cutout *at all times.* Cartridges will always be out of circuit when link has blown.

★ **spots trouble** The tell-tale position of the dropped down cartridge is readily visible from any direction and from distance — spots the trouble quickly and saves hunting.

★ **safe, cool contacts** Positive, heavy contacts and large contact surfaces, elimination of intermediate current carrying parts in circuit path, keep operating temperatures of PVD low.

★ **arc quickly cleared** When link blows, a flip-out device pulls the link apart and out of the cartridge. Arc is positively extinguished before any contacts move or separate. A large airgap between contacts prevents any re-establishing of the arc.

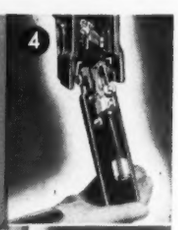
★ **easily, quickly re-fused** Outages are quickly restored. The PVD can be re-fused in one minute — a safe, easy operation right on the pole, even with gloved hands.

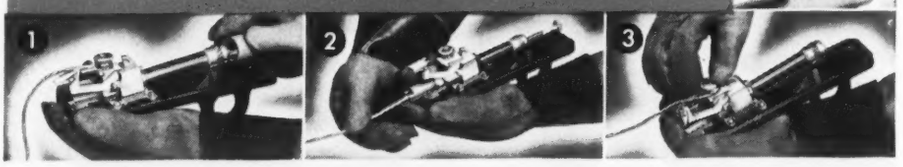
1 Bakelite door of PVD lifts off dead hinge in one easy movement. Fuse cartridge cap is easily unscrewed and removal of blown link is a matter of seconds.

2 New fuse link slides into and through PVD cartridge without a hitch. It is only necessary to replace cartridge cap.

3 In a matter of seconds, the new link is pulled over the flip-out device and fastened with the knurled nut.

4 Door is hooked onto hinge and swung shut in one continuous, easy movement. Entire re-fusing operation can be done without any tools in sixty seconds.





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The Prismalite retains its original high lighting efficiency for life. Its glass prism reflecting surface is utterly free from the mechanical and thermal deterioration which gradually decrease the efficiency of other types of reflectors.

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The L-M Prismalite Luminaire with its clear glass prism reflector ties up no copper or other critical material needed for Victory. Remember, too, that you replace Prismalite glassware in the field. No need to maintain a reserve stock of luminaires to replace those which must be factory repaired.

Get full information from your L-M Field Engineer or nearest L-M Office, or write to Line Material Co., 802 N. 8th St., Milwaukee, Wis., for your copy of the L-M Prismalite Bulletin.

LINE MATERIAL COMPANY

Maintenance of Insulating Oil

XI. Sludge Formation*

By L. M. LIMPUS
Superintendent of Reclamation
Oklahoma Gas & Electric Company

Sludge is an excellent heat insulator and shows a definite preference for collecting upon the heat-radiating surfaces. Those portions of a transformer core radiating the greatest amount of heat will show a deeper and firmer sludge deposit. A grounded core-clamping bolt will collect huge balls of sludge where the bolt protrudes from the flat surface of the core stack. Sludge deposits materially increase internal temperatures, thereby accelerating sludge formation and increasing the deterioration rate of the oil and the fibrous insulations, eventually leading to a breakdown of turn insulation, short circuit and failure. Sludge insulates thermometer bulbs, coil sections, tank walls and plugs oil ducts. It reduces the "flashover" value of insulators and terminal boards, with moisture it forms connecting paths along bushing shanks and apparatus leads, and it offers a definite hazard to the safe continued operation of oil-insulated equipment. Sludge works with the slow, methodical, undermining devastation of the termite, and when the deterioration has progressed to a point of obviousness it is too late to do much about it.

Common Forms

The common forms of sludge found in transformers and regulators are produced as a secondary result of oil oxidation, during which the first oxidation products are polymerized and deposited as a concentrated mass of oil-insoluble particles. Sludge formation in insulating and lubricating oils is today one of the chief concerns of the industrial and petroleum chemists. Sludge is found in many different forms, colors and viscosities, ranging from small microscopic particles to large granular flakes, from light yellow to dark brown or black, and from a very thin scum to a hard resinous lacquer. It may or may not be detected in an oil sample. An actual visual inspection of the apparatus below the oil line, preferably below the top of the submerged winding, is necessary to determine the presence and extent of the sludge deposit. It offers a greater hazard to the larger transformers and regulators and may be considered in a dangerous concentration when its volume approximates $\frac{1}{4}$ to $\frac{1}{2}$ or 1 percent of the total amount of the oil. In the smaller units it may be permitted to reach a concentration of from 1 to 2 percent before serious damage may be expected.

A "normal" sludge deposit approximating $\frac{1}{8}$ to $\frac{1}{4}$ in. depth may often increase the internal temperature from 10 to 15 deg. It therefore follows that such a sludge deposit should not be tolerated as the normal life of the apparatus insulation may be halved or quartered with no apparent demonstration of an existing hazard.

Sludge is ordinarily removed with ease from the core and coil assembly by scrupulous flushing with clean dry oil, under a reasonable pressure which should never exceed 30 lb. per square inch. It is often not so readily removed from the inside surface of the tank wall and may require hand scraping or the use of strong solvents to dislodge it. Although all trace of sludge can be removed from the core assembly, tank, radiators and oil, it will continue to be precipitated until the primary oxidation products, still in a dissolved state in the oil, are satisfactorily removed by some form of re-refinement. Mere replacement of an oxidized oil with new oil is not sufficient to prohibit additional sludging unless all trace of the old sludge is removed before the new oil is added. The old sludge acts as an excellent catalyst and materially hastens the breakdown of the new hydro-carbons. Whenever a large volume of sludge is encountered it can readily be assumed that the oil is at or near a "run-away" sludge value and is unfit for further service until properly reconditioned.

A deposit very similar to one form of sludge is sometimes discovered on the coil assembly. It results from the improper curing of the impregnating varnishes or gums, which have been extruded from the interior of the winding under the heat and pressure developed after the unit was placed in service. Although this deposit has the appearance of a potential trouble maker, it seldom leads to actual failure of the apparatus. If it is hard to remove, it should be left intact unless there is definite evidence of overheating. But some varnishes, if improperly cured, will cause high acidities which cannot be controlled even with repeated oil changes, and when such a condition is experienced the unit should be completely rewound.

*This series began in the October 31, 1942, issue of "Electrical World"; this is the final installment.

•

Fast Method of Coating Washers

Many thousands of metal washers are being reclaimed by the stores department of the Washington Water Power Co., Spokane, Wash. The work is done at the warehouse, under the supervision of Foreman Arthur Thomas.

The washers are tumbled first and then hung on a belt 16 ft. between pulleys. This belt is $1\frac{1}{4}$ in. wide and affixed to its outside surface and perpendicular to it are wire hooks about 4 in. high and spaced about 4 in. apart. As the belt moves over the pulleys and passes to the under side the washers are hung on them by one man.

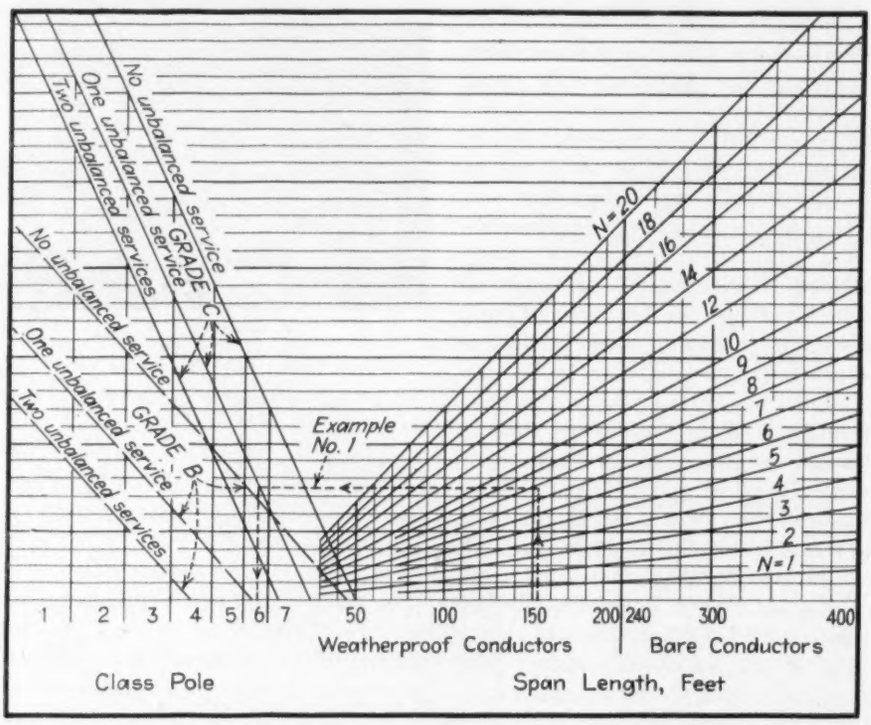
At the middle of the sag on the underside, the washers dip into a tank containing Westinghouse fast-drying transformer paint and are thoroughly coated. By the time they reach the other end they are dry and drop off the hooks of themselves into a receptacle.

The belt is driven by a $\frac{1}{2}$-hp. motor equipped with an old sign flasher reduction driving the 14-in. pulley. Two to four minutes is required to treat 172 washers.

HOW CHATTANOOGA MUNICIPAL SELECTS WOOD POLES FOR OVERHEAD DISTRIBUTION

By GEORGE R. PARKER
Chief Engineer Electric Power Board of Chattanooga, Tenn.

The accompanying chart is intended to provide a ready means for determining the proper class pole, and to this end extreme accuracy is sacrified in favor of simplicity. The chart is based on the loading conditions and safety factors prescribed by the Fifth (September 23, 1941) edition of the National Electrical Safety Code and on spacings and sizes of conductors standard for Chattanooga E.P.B. construction and also loads for medium-loading districts. Load of all distribution conductors is assumed to be applied 2 ft. from the top of the pole and telephone loads are adjusted to an equivalent. Minimum pole strengths as set out in A.S.A. specifications with appropriate safety factors are used.



Instructions for Use of Chart

Determine a value for *N* by summing up the value of each conductor supported taken as follows: 1 for each conductor No. 2 or smaller; 1.5 for No. 1 and larger; 3 for telephone cable and 6M messenger; 4 for telephone cable and 10 or 16M messenger; 5 for telephone cable and 25M messenger; ¾ for each telephone wire 0.104 in. diameter and smaller.

Enter chart at the span length under consideration and follow vertically to its intersection with the diagonal for *N* as determined in preceding paragraph; project horizontally to an intersection with the diagonal representing the condition of unbalanced services for the grade of construction to be used and read below the class pole required:

Span lengths up to 200 ft. are for weatherproof (WP) conductors and those from 240 to 400 ft. are for bare conductors. Where dealing with both weatherproof and bare conductors, convert one to the equivalent of the other. To convert weatherproof to bare, multiply the value of *N* for the weatherproof conductors by 1.2; conversely, to convert bare to weatherproof divide by 1.2 or multiply by 0.83. If *N* as determined is in terms of bare conductor and the span is less than 240 ft. or, if weatherproof, more than 200 ft., an equivalent span length can be arrived at by multiplying the span length by any convenient figure and dividing the value of *N* by the same figure, or *vice versa*.

Example No. 1—Given two No. 6 W.P. primaries, three No. 4 W.P. secondaries, telephone and 6M messenger, one unbalanced service, 150-ft. span. Find class pole for Grade C construction.

N equals 2 plus 3 plus 3, or 8. From the chart it is found that a class 6 pole is required.

Example No. 2—Given six No. 4/0 bare, double-circuit, 11-kv., 200-ft. span. Find class pole for Grade B construction.

N equals 6x1.5 or 9. Since the span is 200 ft. and the conductors are bare, it will be necessary to use an equivalent span. This can be done by multiplying the span length and dividing *N* by 2, which gives a span of 400 ft. and value of *N* of 4.5. From the chart the class pole required is 5. The same result is obtained if *N* is converted to terms of weatherproof conductors by dividing by 1.2 and using the 200-ft. span.

Example No. 3—Given three No. 4/0 bare 11-kv., three No. 2/0 W.P. primaries, two No. 6 W.P. street lights, three No. 4 W.P. secondaries, span length 140 ft., two unbalanced services. Find class pole for Grade C construction.

N equals 3x1.5x0.83 plus 3x1.5 plus 2 plus 4, or 13.25. From the chart class 4 pole is required.

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Sketched from an installation in New York State, erected by the U. S. Engineers and prefabricated by the American Crossarm and Conduit Company, Chicago.

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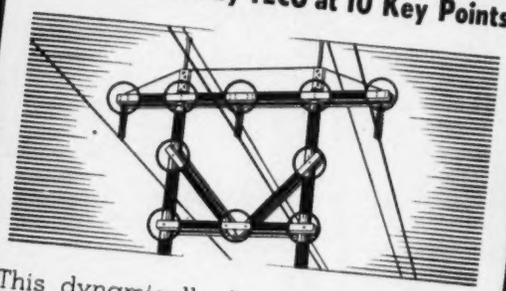

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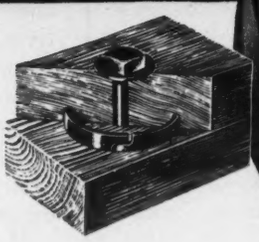

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Alter Valve Sequence for Steam Economy

By R. F. DAVIS
Chief Engineer Michigan City Station, Northern Indiana Public Service Company, Michigan City, Ind.

When the 68,000-kw. turbine was built for the Michigan City generating station of the Northern Indiana Public Service Company intention was that it would operate at loads of 45,000 kw. or above a majority of the time. Therefore, the turbine was equipped with three sets of nozzles and three hydraulically operated steam admission valves, controlled by a hydraulic governor.

Nozzle areas on this machine are as follows: Primary, 16 sq.in.; secondary, 17 sq.in.; tertiary, 6.7 sq.in. The normal valve sequence was primary, secondary and tertiary. The primary nozzles carry about 47,000 kw. net, the secondary set 20,000 kw. and the tertiary about 18,000 kw. net.

Because of load requirements, this turbine in recent years has operated at loads of 20,000 kw. net for as high as 30 percent of some months with quite a little operation on loads of 30,000 kw. net and 64,000 kw. net.

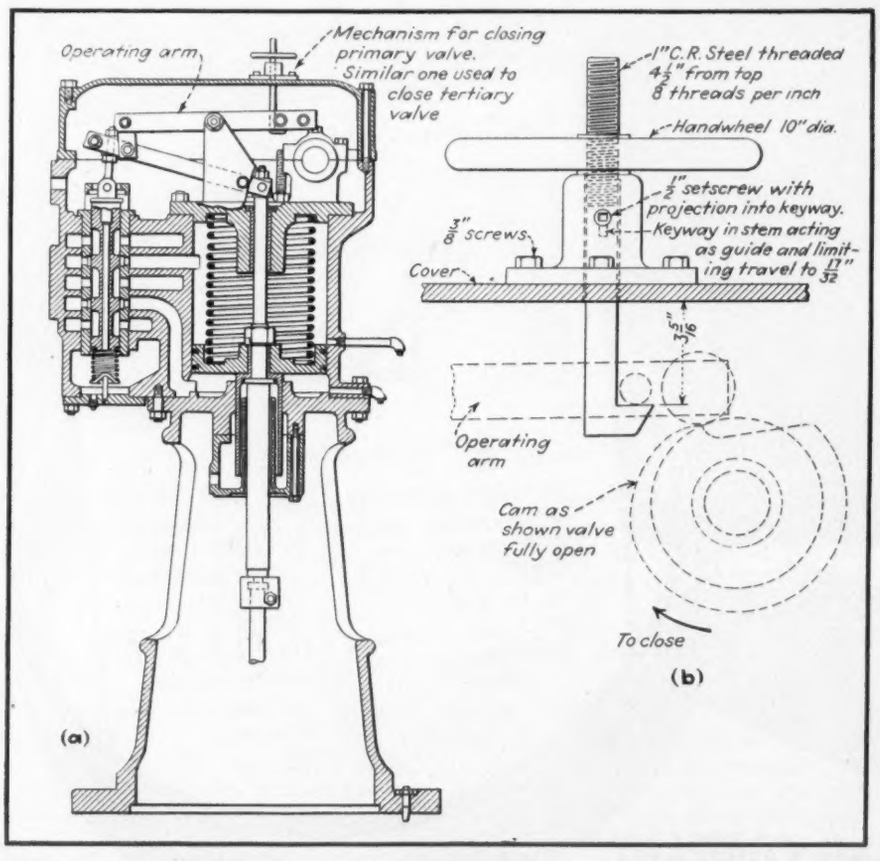
Therefore. it was decided, for reasons of steam economy, to arrange the operation of the valves to permit the turbine to operate at more nearly its designed inlet nozzle pressures at the predominating loads. This was done and the plant is now being operated with the secondary nozzle carrying the load at 20,000 kw., the secondary and tertiary carrying all loads up to 37,000 kw. The tertiary valve is closed at loads of 64,000 kw., but at all other loads the valves are operating in their normal sequence.

This machine is a combination impulse and reaction turbine with impulse blading carrying about one-quarter of the load. Prior to the rearrangement of the valve operation, when the unit was carrying 20,000 kw. net on the primary nozzles, main header pressure was 680 lb. psi. and inlet pressure to the nozzle about 400 lb. psi. At 64,000 kw., on the other hand, the primary valve was wide open and the nozzle pressure about 670 lb. psi.; the secondary valve was almost wide open with the nozzle pressure 610 lb. and the tertiary valve was open slightly with nozzle pressure but little higher than that in the impulse chamber.

In this turbine steam admission valves are operated by the governor through a shaft and cam arrangement which operates the valve mechanism. Each valve is operated by oil under pressure which is admitted to or discharged from the operating system by a relay actuated by a cam attached to the shaft of the governor. This opens the relay and admits oil to the top of the piston closing the valve.

With this arrangement any changes in the valve and cam mechanism to effect the desired operation automatically appeared rather complicated and costly. Accordingly a manually operating mechanism was built at a very small cost and installed on the primary and tertiary valve relay operating levers. This manual mechanism merely lifts the relay operating arm above the cam to the closed position. Elements of the scheme are shown in the accompanying drawing. While tests show no startling percentage of saving by this arrangement, operating results show a small saving which over a year's time amounts to several thousand dollars.

While this is not presented as an outstanding achievement, it is given to call attention to one of the many small things that can be done around generating stations with existing equipment to effect a considerable saving.


Operating arm
Mechanism for closing primary valve. Similar one used to close tertiary valve
1" C.R. Steel threaded 4½" from top 8 threads per inch
Handwheel 10" dia.
1/2" setscrew with projection into keyway.
Keyway in stem acting as guide and limiting travel to 17/32"
8¾" screws
Cover
3 5/16"
Operating arm
Cam as shown valve fully open
To close
(a)
(b)

SIMPLE valve-closing mechanism (a) added to primary and tertiary steam admission valves improves turbine steam economy; detail of mechanism is shown in (b)

Cold Cathode Tubes Used on Relays—IV

By E. C. SCHURCH
Senior Electrical Engineer, Electrical Design Section, Bureau of Reclamation, Denver, Colo.

A directional ground relay is another type of protective relay using cold cathode gas-filled tubes as a fault-detecting agent. The circuit for the relay is shown in an accompanying connection diagram.

This relay operates on the sum of the residual currents from the main and polarizing current transformers and is applicable where these currents do not differ too greatly. Saturation of transformers T_1 and T_2 is controlled so that the voltage E_1 obtained from either of the transformers separately, for maximum fault currents, is slightly below the operating voltage of the tube.

If the currents from the main and polarizing current transformers are of the same instantaneous polarity, the two resulting secondary potentials will be additive and the relay

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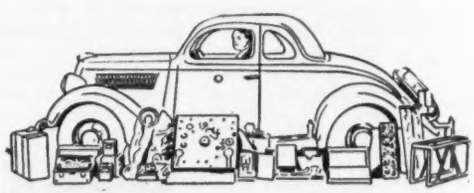

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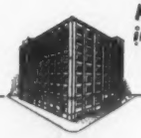

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whose electrical output is the Lifeblood of War Production

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Electric Power has now become the yardstick of a nation's capacity for war. Here in America ours is almost limitless; thanks to the foresight of our power makers, the supply of electrical energy has always paced demand. It is not an accident that every war plant in America that needed more electric power got it when and where it was needed.

Forward planning has always been a characteristic of the utility industry. It has never waited until a demand for power developed. Theirs has been the job of anticipating demand and being "Johnny-on-the-spot" with adequate facilities so that when a switch was thrown, there was power available in the quantity needed. That is why America's war producing machinery went into high gear so soon. That is why the "Power" Hitler forgot is now making itself felt on all fronts, and will continue to increase into a mighty crescendo of thundering tanks, planes, guns and ships to overwhelm and completely destroy the evil forces that would enslave us.

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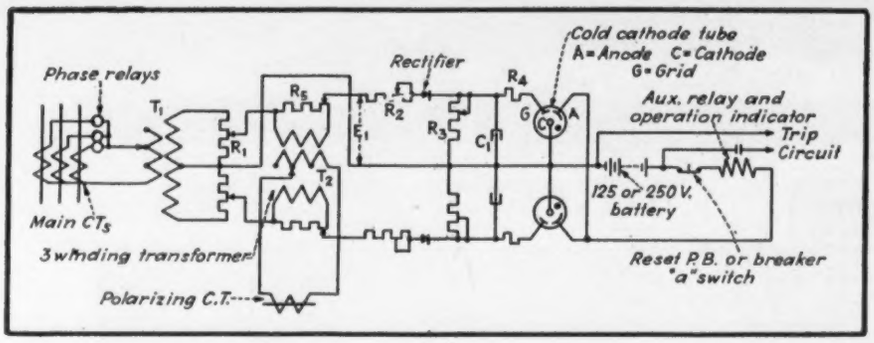
C O R P O R A T I O N



CONNECTIONS for directional ground relay

will operate on the sum of the two potentials, but, if of opposite instantaneous polarity, the two potentials will be subtractive and the difference will not be sufficient to operate the relay. In other respects the relay functions the same as the overcurrent relay described in a previous article in this series.

Reference to the connection diagrams for the directional ground relay, single-phase overcurrent relay and differential type relay (for the latter two relays see ELECTRICAL WORLD, February 20, 1943, page 82; March 6, 1943, page 76) will indicate that the circuits, with certain modifications, would be suitable for several other types of protective relays, particularly over-current relays with potential restraint, overvoltage and overfrequency relays.

•

Applying Grounding Transformers—I

By H. FAHNOE
Transformer Engineering Department,
Westinghouse Electric & Manufacturing Company,
Sharon, Pa.

Where a grounding transformer is used the windings and connections employed, effectiveness of a unit and a method for determining the rating are subjects explained here relative to the application of the unit.

A grounding transformer is usually installed when it is impossible to ground the neutral of a generator, or when the neutral of the three-phase system is not available and it is desired to establish a neutral ground connection for relaying purposes.

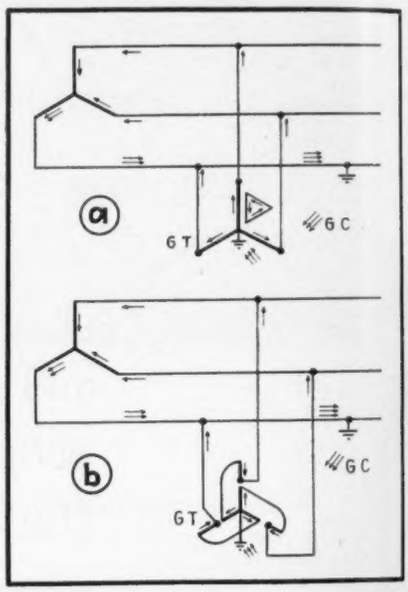
The interconnected-wye or zigzag arrangement and the wye-delta connection are the hook-ups generally employed for grounding transformers. In regard to their ability to limit ground current, these winding arrangements are equally good. They may be built as three separate single-phase units or as one three-phase unit, the latter being more compact.

Flow of ground currents in a wye-delta grounding transformer, when a fault to ground occurs on one line of a three-phase system, and current flow for similar conditions in an interconnected-wye grounding transformer are shown in diagrams (a) and (b), respectively, in the illustration. The ground current divides equally between the three windings and is limited by the leakage impedance between windings on the same core.

Theoretically, when no fault exists the only current which would flow in the grounding transformer would be the no-load current of the grounding transformer itself. Practically speaking, the initial temperature rise would be determined by the no-load loss. However, there is usually a certain amount of unbalance on the system, and this will result in a load on the grounding transformer. For this reason the windings of a grounding transformer, according to A.I.E.E. Standardization Rules, are assumed to be at a temperature of 75 deg. C. at the time a ground fault occurs.

A grounding transformer installation should have sufficient capacity to hold the neutral of the system near ground potential; otherwise, the system to which it is connected may take on the characteristics of an ungrounded system. If the zero-sequence impedance of the grounding transformer is high in comparison with the positive-sequence impedance of the system, and a fault occurs in one phase, then the voltage on a non-faulted phase will approximate the condition of a free-neutral system. The effectiveness of the grounding transformer, in this respect, may be taken as the ratio of its zero-sequence impedance (plus any other external zero-sequence impedance) to the positive-sequence impedance at any point on the system to which the grounding transformer is connected. When this ratio is three or less, the system may be considered solidly grounded.

Current rating of a grounding transformer may be established from the zero-sequence impedance, determined from this ratio, and the line-to-neutral voltage of the system. The current rating is generally specified as the neutral (or ground) current that flows when a solid one-phase line-to-ground fault occurs at the transformer terminals, assuming full supply voltage is maintained. Rating of the grounding transformer is expressed in kva. based on line-to-neutral voltage and ground current. The



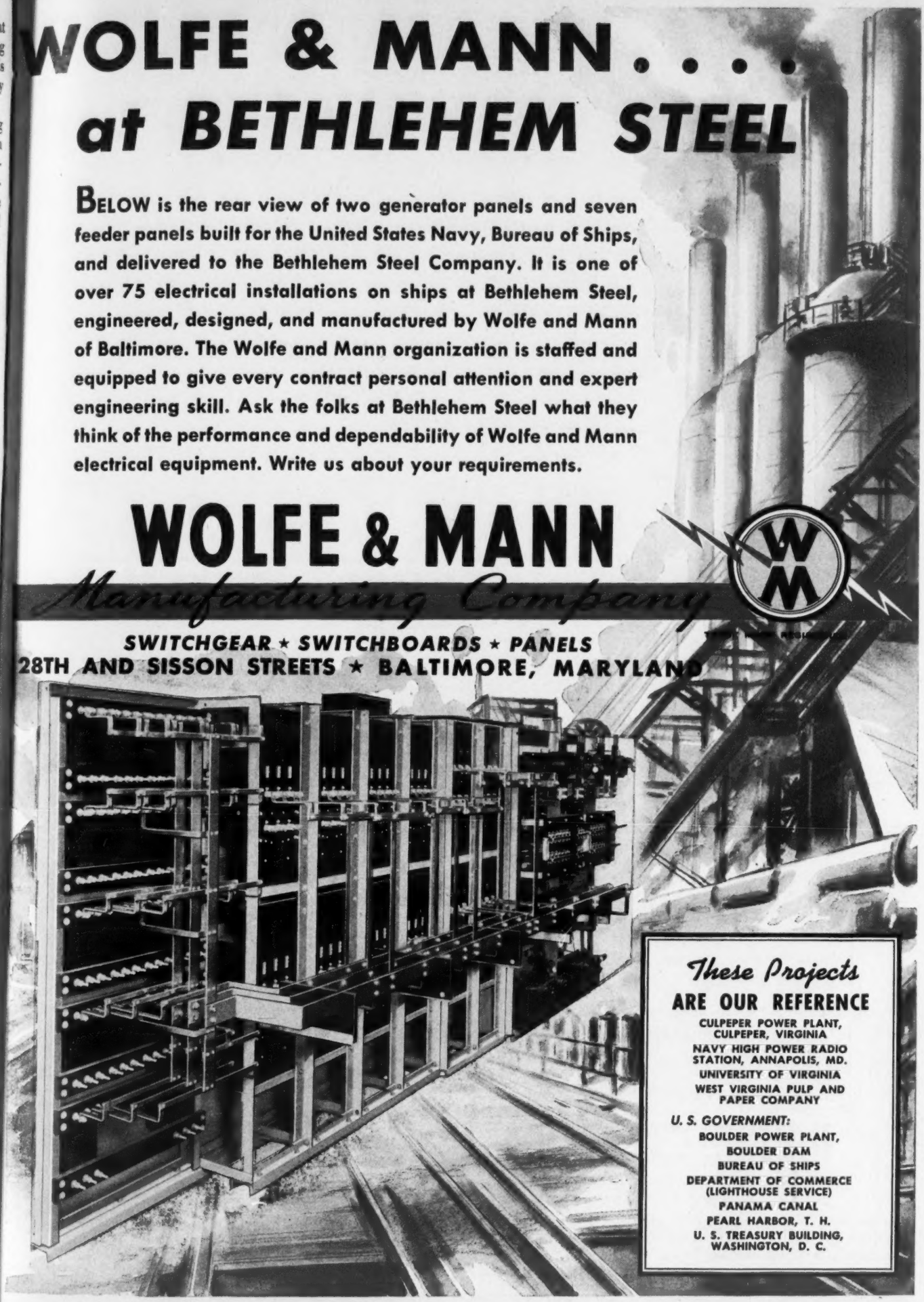
FLOW of ground current through grounding transformer with (a) wye-delta connection and (b) interconnected-wye or zigzag arrangement. Generator (left) and fault shown. GC=ground current; GT=grounding transformer

currents in the wye windings are one-third of the ground current.

According to the A.I.E.E. Standardization rules, the transformer should be capable of carrying the rated ground current for at least 60 seconds. At the end of this period the maximum permissible ultimate temperature of the windings must not exceed 160 deg. C., based on an initial temperature of 75 deg. C. The temperature rise is based on calculations which assume that all heat from copper loss is stored in the copper during the short-circuit period.

How to determine size of parts used for a grounding transformer will be presented in a subsequent issue.

WOLFE & MANN . . . . at BETHLEHEM STEEL



BELOW is the rear view of two generator panels and seven feeder panels built for the United States Navy, Bureau of Ships, and delivered to the Bethlehem Steel Company. It is one of over 75 electrical installations on ships at Bethlehem Steel, engineered, designed, and manufactured by Wolfe and Mann of Baltimore. The Wolfe and Mann organization is staffed and equipped to give every contract personal attention and expert engineering skill. Ask the folks at Bethlehem Steel what they think of the performance and dependability of Wolfe and Mann electrical equipment. Write us about your requirements.

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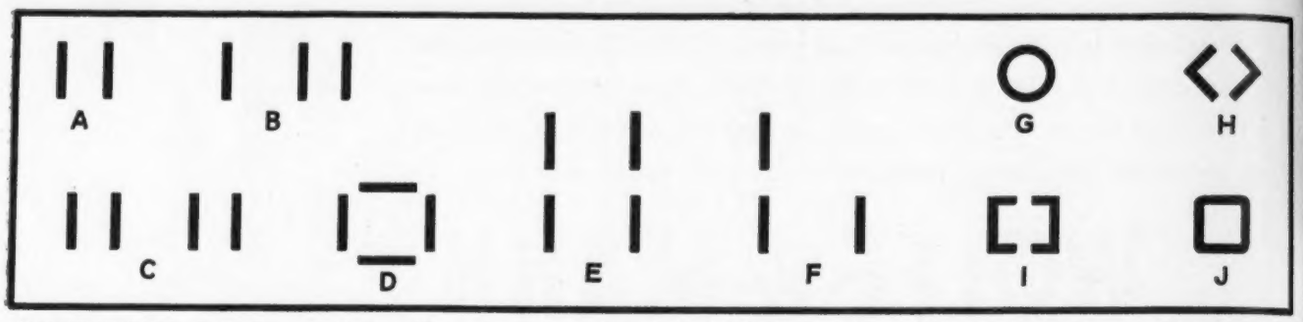
HOW TO ARRANGE
BUS CONDUCTORS FOR AN A.C. SYSTEM*

By WILLIAM DEANS
Chief Engineer I-T-E Circuit Breaker Company, Philadelphia, Pa.

An essentially hollow conductor is considered the most efficient current carrier for alternating current; skin effect is reduced to a minimum for 60-cycle current. Following that theory, when flat bars are used it is usual to arrange the individual bars so as to simulate, so far as the number of bars will permit, the hollow square.

Structural shapes such as angles, channels, square and circular tubes are frequently used. For these the skin effect ratios are expected, in general, to fall within a narrow range.



ARRANGEMENT of flat-bar conductors (A to F) and structural-shaped conductors (G to J) for high-current capacities per phase

A. Two flat bars in parallel, longer dimensions vertical, form two sides of a hollow conductor, the top and bottom missing.

B. When three bars are required, one is located remotely from other two, which are close together. If middle bar is equidistant from outside bars, latter two will carry more than their share of the current. Also compare F.

C. Four bars in two pairs; bars in each pair relatively close together, and two pairs relatively far apart, to obtain low proximity effect.

D. Four bars simulate hollow square; arrangement is very efficient current carrier. Difficult to take off taps and make connections. Having two horizontal bars less heat is dissipated, consequently current-carrying capacity is less than if all four bars were arranged vertically.

E. Modified hollow square; all bars vertical; very effective as to heat dissipation. Skin effect not quite as good as for arrangement D, but net result is that the current-carrying capacity of modified hollow square is much better than that of full hollow square.

F. Three bars form modified hollow square. More efficient carrier of current than arrangement B.

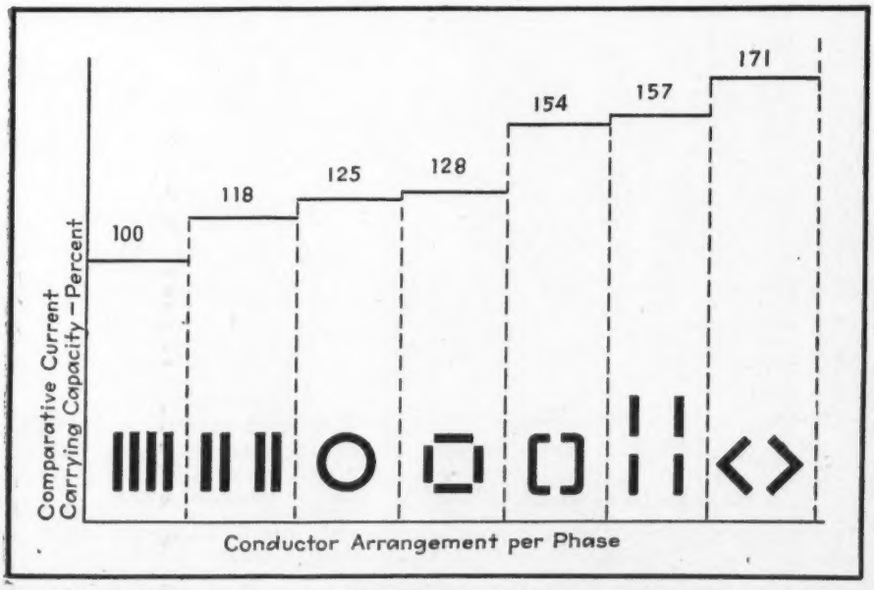
G. Circular tube, skin effect is low.

H. Pair of angles, form roughly a square. Skin effect ratio approximates that of circular tube. Angles being separated allows some ventilation on both inside surfaces, hence the pair of angles is much better current carrier than the circular tube.

I. Pair of channels; same reasoning applies as for angles (H).

J. Full square; has approximately same skin effect as pair of channels. Current carrying capacity same as for a pair of channels, weight for weight, when furnished with holes in top and bottom to provide for ventilation of inside surfaces.

NOTE:—Circular and square tubes and pairs of channels present little difficulty in taking off taps and making connections. Assemblies of flat bars are somewhat more difficult to handle in this respect. Pairs of angles and pairs of channels require more consideration as to support and mounting than do simple element conductors, such as tubes. Flat bars require more consideration than any of these and they are more troublesome when forces due to electromagnetic action at high currents is considered.



COMPARISON of current-carrying capacities for various arrangements of conductors per phase

*This is the seventh and concluding article in a series on the general subject of Bus Design, which began in the December 26, 1942, issue of "Electrical World."

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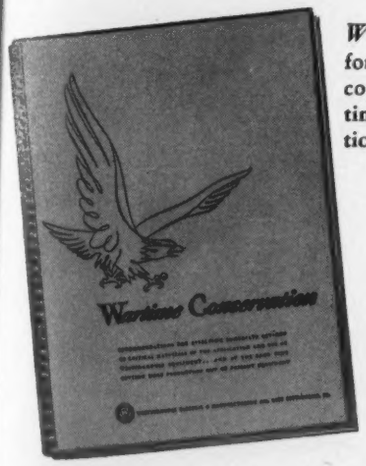

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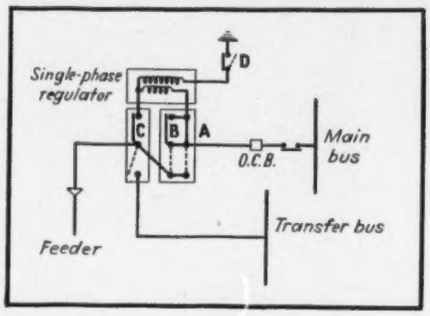
Switch Scheme to By-Pass Regulators

Shown in the diagram is the standard switching scheme used by the Wisconsin Electric Power Company, Milwaukee, for by-passing single-phase feeder voltage regulators so that they or the main feeder breakers may be removed from service for maintenance or inspection.

Feeder load is carried by a transfer bus. This regulator transfer bus is used only when it is desired to take the feeder oil circuit breaker out of service. The transfer bus is energized through an oil circuit breaker and regulator from the main bus.



THREE single-pole, double-throw disconnect switches arranged to by-pass single-phase regulators

To remove regulator from service:
1. Set regulator on neutral.
2. Throw blade B down.
3. Open switch D.
4. Throw blade A down.
5. Open blade C (do not close it on transfer bus unless it is desired to remove breaker from service).

To restore regulator to service:
1. Throw blade C up.
2. Close switch D.
3. Throw blade A up.
4. Throw blade B up.
5. Run regulator off neutral.

Switching circuit used is shown with the feeder regulator in service and supplied by the main bus. Switch positions with the regulator out of service are shown dotted.

The arrangement uses three single-pole, double-throw disconnect switches with terminals bonded as shown for by-passing the regulator. A single-pole, single-throw disconnect switch in the ground connection to the regulator exciter winding breaks exciting current when feeder load has been shifted to the transfer bus.

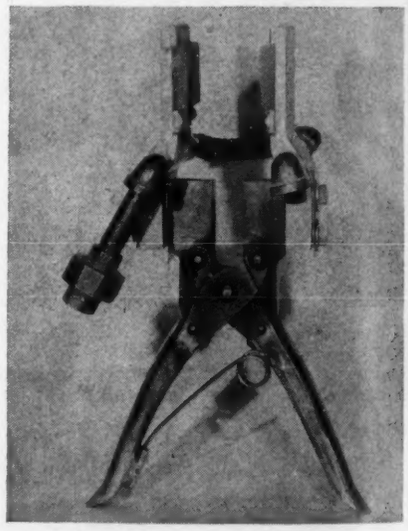
If it is desired to remove the oil circuit breaker from service, the transfer bus should first be energized, the regulator by-passed in the usual way and blade "C" thrown down on to the transfer bus. Blades "A" and "B" should then be opened to isolate the oil circuit breaker. In placing the circuit breaker and regulator back in service, the main circuit breaker is closed and the usual procedure followed in placing the regulator in service, after which the transfer bus is de-energized.

•

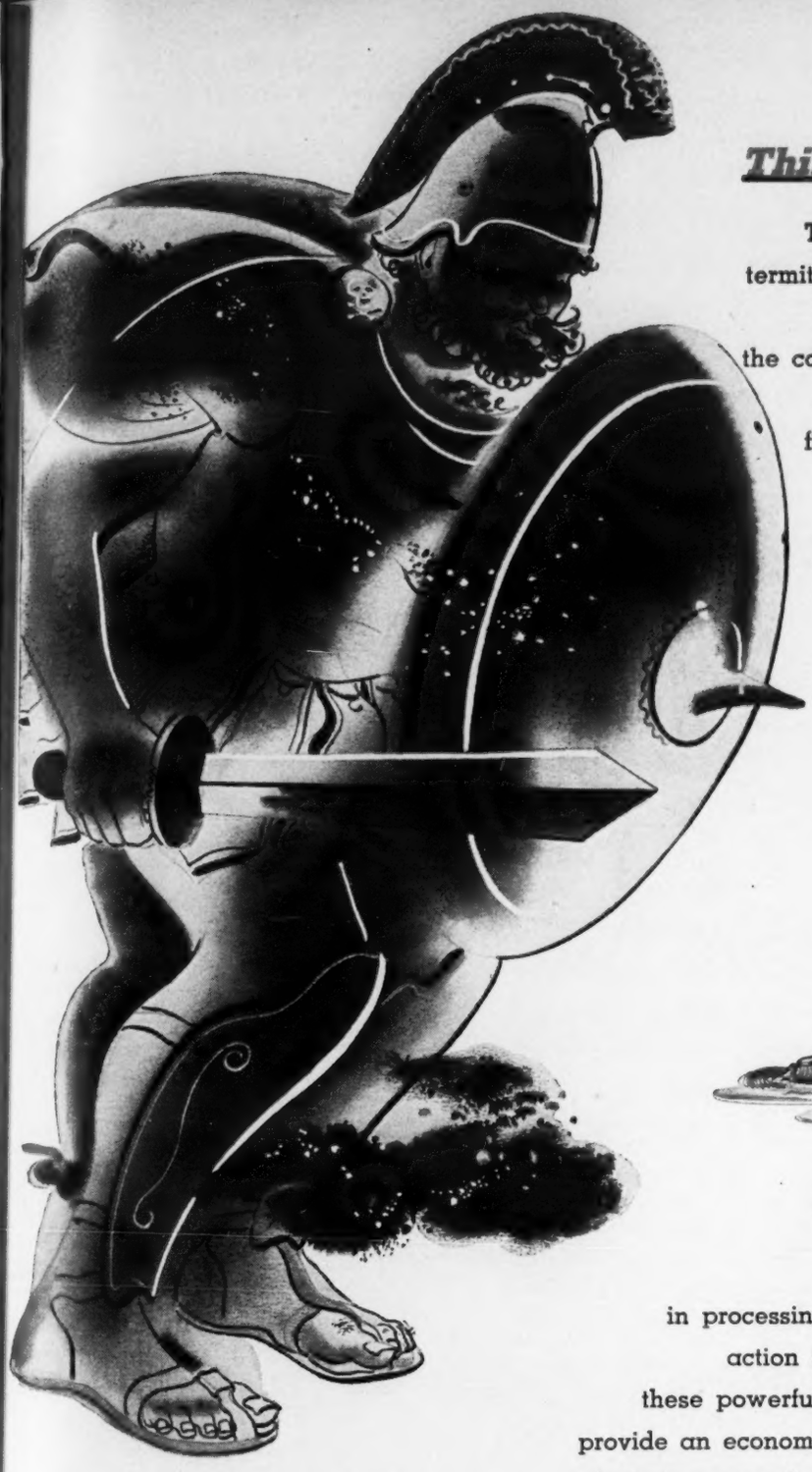
Water-cooled Brazing Tongs From Pliers

A pair of water-cooled tongs has been built up from a pair of 8-in. parallel flat nose pliers. The tongs are used as carbon holders in the incandescent carbon process of silver brazing, and are said to be cool, light and efficient in operation. The new type of equipment is a development at General Electric's Schenectady plant to meet production requirements with silver brazing, this process having increased greatly in use due to the shortage of tin for soldering.

In the making of the tongs, steel blocks are first welded onto the plier jaws to give them an outside width of $\frac{1}{2}$ in. when closed. These blocks are then drilled and tapped for $\frac{3}{8}$-in. bolts. Bar copper of varying dimensions is bent to fit the clearances required for the particular job to be handled, and the tips are cut to hold small blocks of carbon. The bars are drilled and tapped to accommodate $\frac{1}{4}$-in. pipe fittings by means of which water-cooled power leads are attached. A rubber hose jumper forms a water connection between the jaws, and ad-



PLIERS developed into water-cooled brazing tongs



This War Will Last Forever

The war against mold, decay, germs and termites is your daily business. It is important business—business that doesn't wait—for the cost in both time and materials runs high. To help in this endless industrial fight against fungi and bacteria, Dow has developed a series of 17 chlorinated phenolic derivatives—the *Dowicides*. These products have proved their value in many fields—paper, leather, paint, lumber, textile, and many more.

Dowicides are employed in finishing compositions and in processing operations. In all cases, the inhibiting action is thorough and dependable. Investigate these powerful germicides and fungicides today. They provide an economical and effective way to improve manufacturing operations and make vital materials last longer.

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SAFETY FACTORS

PREVENT PRODUCTION SLOWDOWNS

Switch failures slow up production. That's why Federal "Sealed Arc" Safety Switches* are built with extra safety factors to insure continuous, dependable, trouble-free operation on essential circuits. Federal's "Sealed Arc" construction, for instance, is a confining porcelain "straightjacket" with ribbed arcing chutes that break up and snuff the arc before it can do damage.

Other safety factors that are making Federal switches "musts" with more and more manufacturers are:—dead front shields over live parts, high grade insulating material throughout, ample spacing between live and grounded parts, unobstructed wiring, rugged construction to insure permanent alignment of working parts, and patented "grip-tite" fuse clamps for better connections. Follow the leaders—for extra service and safety switch to Federal!

** "Sealed Arc" construction up to 200 Amperes. 400 to 1200 Amperes Knife Blade Type.*

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ditional water carriers may be drilled the entire length of the bars if necessary. Mica sheets and bushings are used for insulation between parts and pliers.

A single-loop pronged spring of 0.091-in. wire, welded at one end and free at the other between the handles of the pliers, provides sufficient force to open the jaws when the braze is completed.

•

Restoring Meter Jewels to Service

Inspection of meter jewels at the general service buildings of the Narragansett Electric Company, Providence, R. I., is resulting in a substantial percentage of returns to use, according to a statement by H. C. Rankin, New England Power Service Company, before the New England Association of Meter Engineers. Since meter jewel supply and replacement by commercial companies was interrupted by the war, a considerable stock of watt-hour meter jewels has been collected at Providence. Shortage of critical materials for jewel mountings and condition of the jewel market have necessitated the return of all usable jewels to service. The work done at Providence should probably be classified as inspection rather than salvage, as no attempt has been made to repolish or reset any jewels showing signs of wear or other damage.

Discarded jewels have been cleaned with L & R cleaning solution to which a small amount of household ammonia has been added. This has been followed with a double dousing with L & R rinse solution and a heated drying. Inspections have been made under a binocular microscope having a magnification of about 85. The jewel holder is designed to permit rotation around the jewel axis and also the rotation of the jewel in one plane around the focal point under observation. Lighting is applied from a 6-volt flashlight bulb filtered through white frosted glass and operated slightly below rated voltage on a movable stand which allows lighting from any angle.

Shipments from various New England Power System companies totaled 14,496 jewels representing a large distribution of both meter and jewel manufacturers. From these it was possible immediately to return to

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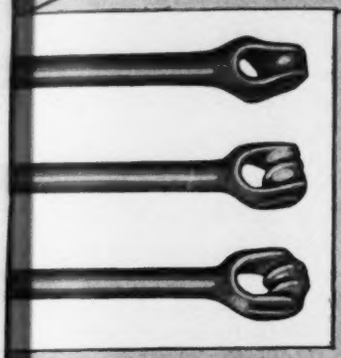

ANCHOR RODS . . .

Oliver Anchor Rods and Anchors are available in many types, sizes and lengths to meet the needs of various anchoring conditions. Thimbleye and Twin-eye types available as well as regular oval eyes. All are hot dip galvanized.

GUY SHIMS, PLATES, HOOKS, BOLTS

Considerable flexibility in the method of attaching the guying strand to the pole is afforded by Oliver equipment. In addition to a complete line of shims, strain plates, guy hooks and lag screws, Oliver makes angle Thimbleye Bolts in various sizes and lengths for guying. Because they speed pole erection and save materials, Thimbleye Angle Bolts are gaining widespread popularity.

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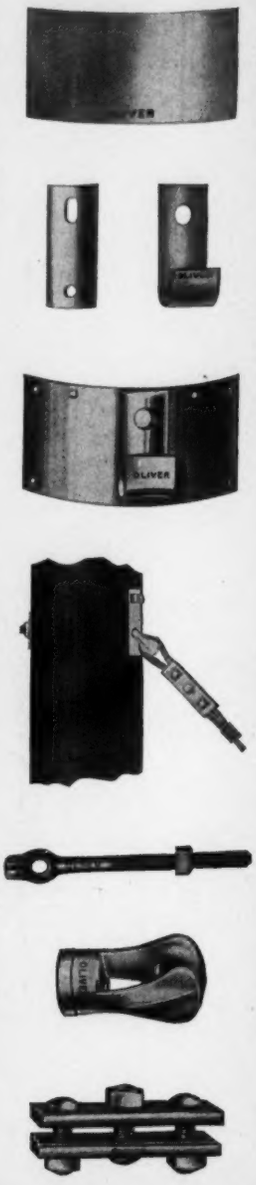
Oliver Guy Clamps are made from hot rolled, open hearth steel. Furnished in light and heavy types, and in three lengths in each weight. Long, smooth clamping surface gives greater holding power.



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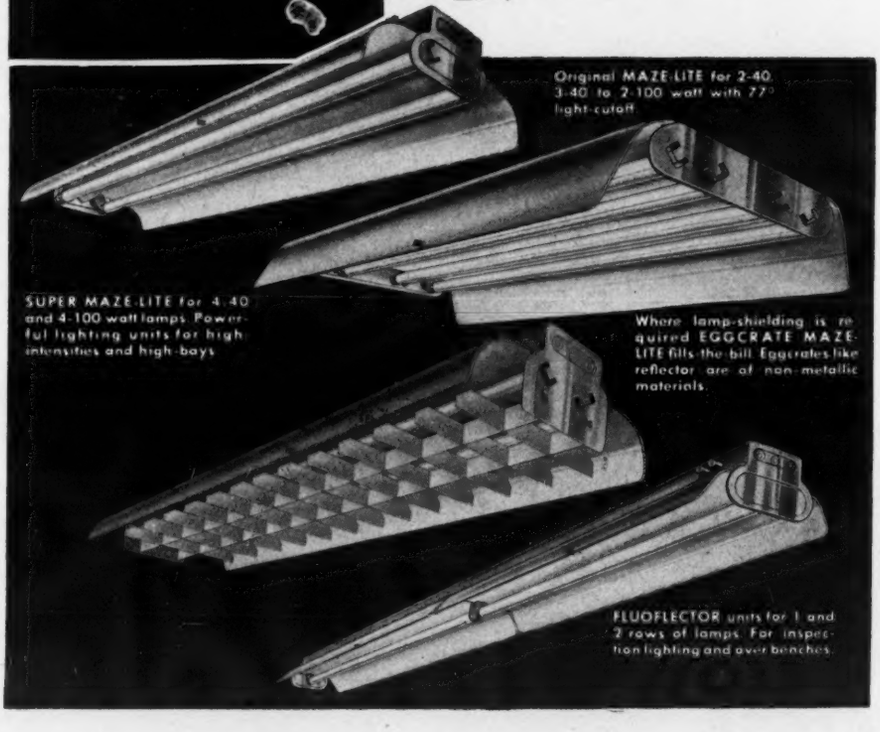
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service 8,135 or 56 percent. These jewels showed no evidence of wear or other damage. Of the remainder it was estimated that about one-half might be returned to service if at some future date the scarcity of perfect jewels makes this necessary. These imperfect jewels showed evidence of very slight wear, but none of cracks or serious wear rings, and might be used on small revenue meters.

Costs of Inspection Warranted

The costs involved justified the inspection. This was done at the rate of 50 jewels per hour and consisted of a labor cost of $1.28 per hour, to which 100 percent was added to cover equipment, cleaning fluid, supervision, floor space, etc. The purchase cost of the jewels immediately returned to service was of the order of 225 percent of this inspection cost, yielding an approximate net of 125 percent on the operation. It is believed that this inspection is well justified in view of the difficulty in obtaining manufacturers' inspections. This salvage figure of 56 percent is considerably higher than had formerly been obtained from manufacturers who were refurbishing and/or replacing jewels indicating wear.

•

Now Machine Cleans Hydro Plant Tunnels

B. T. C. STAVERT
Southern California Edison Company, Los Angeles, Calif.

Periodic cleaning of caddis fly larvæ growths from power station tunnels, flumes and pipe lines, in order that these facilities might carry water at their maximum capacity and thus insure full plant efficiency, has been a problem of the Southern California Edison Company since 1922. Only recently has a successful machine been devised which will substitute for the 20 to 25 men previously required to do this work by hand.

At the Kern River plants the larvæ problem is a serious one in that it is necessary to unwater the flowlines to clean them. These tunnels are of approximately 9-ft. cross-section, one 8½ miles long and the other 13 miles long. Experience has been that the infestation extends into the tunnels approximately 1 mile below the river intakes. In three months,

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If you follow this free plan you not only help yourself, but more important, you help the war effort. This manual provides a practical automatic method for complete analysis of circuits and equipment... uncovers potential weaknesses ... methods for correcting them... with charts to enable quick periodic check-ups.

NOTE: Through this Preventive Maintenance Plan you may uncover the evidence necessary to obtain an "emergency repair priority." This is explained fully in the plan book. 43225

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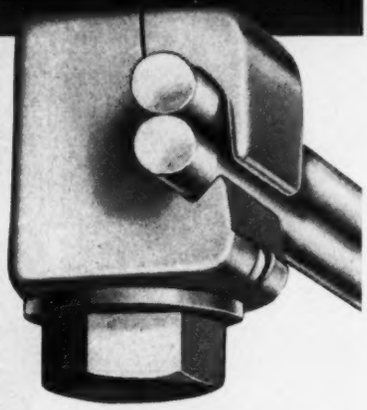

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March to May, during which time the insects are growing, tunnel restriction gradually increases until a reduction in water-carrying capacity as high as 10 percent occurs.

Prior to 1939, once and in a few cases twice a year, the larvæ and cases were removed by hand with local labor. Steel scrapers and brushes were used and with 20 to 25 men it was possible to clean the infested portion of a line in six to eight hours.

Tightening of the labor market, which began to make itself felt in 1939, made it impossible to obtain sufficient help for a short job such as this. It was necessary, therefore, to devise other means of cleaning. Experiments demonstrated that these tunnels could be washed free of caddis fly by directing high-pressure water jets against the walls and floor at a cutting angle, with a resulting job more thorough than the old hand method.

During the past three years considerable thought has been given to the development of a practical washing unit. This has resulted in the present mechanism, the use of which makes it possible to wash 1 mile of tunnel in about six hours using only three men.

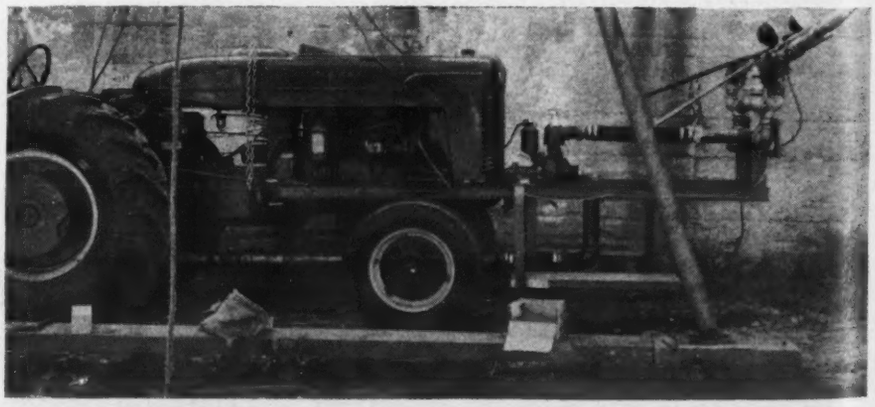
In brief, this mechanism consists of a tractor on which is mounted a 200-g.p.m. water pump which discharges through two $\frac{5}{8}$-in. nozzles at 90 lb. per sq.in. These nozzles are set at an angle found most suitable for cleaning and are connected to a crank mechanism driven from the tractor by a V-belt. By the use of suitable links it is possible to drive the nozzles through the desired arc either vertically or horizontally. With this arrangement it is only necessary to drive the unit through a tunnel to wash all foreign matter from the walls. A second trip is necessary to wash the floor.

TYPICAL caddis fly larvae infestation of hydro plant tunnel wall, which materially reduces flow capacity

Section free from larvæ was due to application of waterproof grease one year earlier. Grease prevented attachment for two years.

Water supply comes from the tunnel itself; the floor is left covered to a depth of a few inches.

At the smaller southern California plants pipe lines of from 20 in. to 40 in. in diameter, carrying water at high velocity, are similarly infested by larvæ of the caddis fly. These lines are cleaned by sweeping with a bundle of live oak twigs. The sweep is made up by wiring the twigs together to form a ball with a diameter about $1\frac{1}{2}$ times that of the pipe to be cleaned. With a full flow of water the bundle of brush is dropped into the pipe intake and allowed to pass through the water. This is done as often as necessary and results are very satisfactory.



TUNNEL washing machine devised to replace 25 men previously used for this job; mechanical drive mechanism for nozzles is not shown

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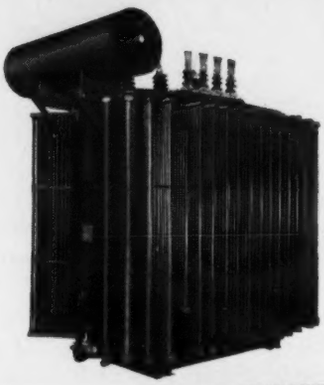
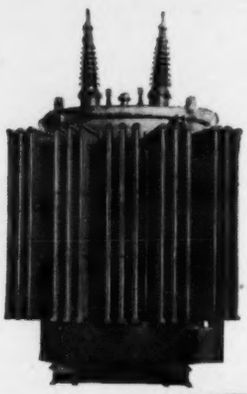
25 KV
21 DAYS OR BETTER

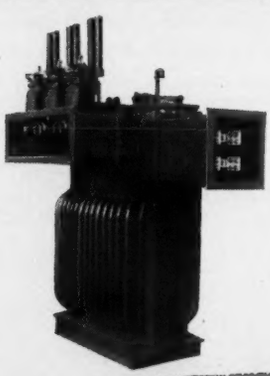


5000 KVA
34.5 KV
35 DAYS OR BETTER



10,000 KVA
66 KV
45 DAYS OR BETTER

20,000 KVA
115 KV
55 DAYS OR BETTER



INDUSTRIAL TRANSFORMER UNIT SUBSTATION TYPE 300 KVA
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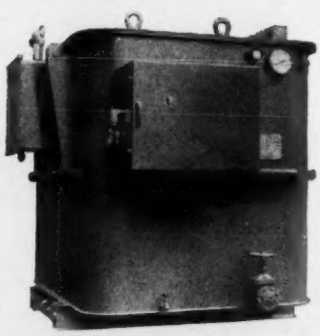

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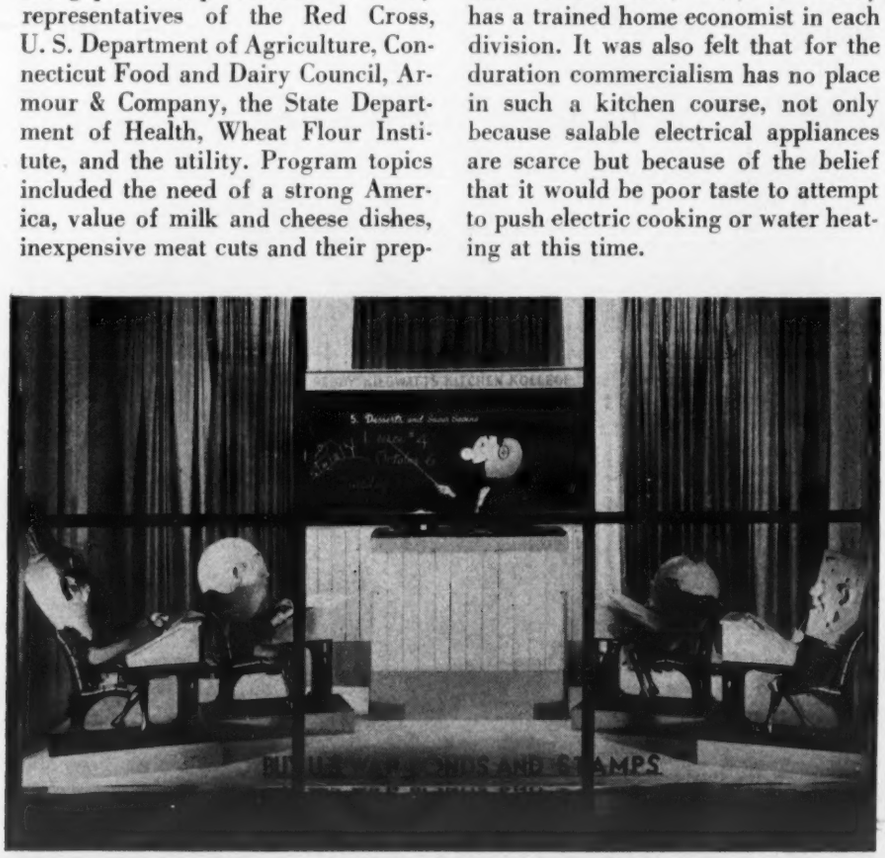
"Kitchen Kollege" Aids Homemakers

To help housewives and others utilize foodstuffs, electric cooking and refrigeration to maximum advantage under wartime conditions, the United Illuminating Company recently conducted a "Reddy Kilowat Kooking Kollege" at New Haven, and Bridgeport, Conn., which was attended by 2,581 persons interested in this phase of household economics. Ten weekly afternoon lecture-demonstrations were given in New Haven and ten in Bridgeport. The presentations were by representatives of the Red Cross, U. S. Department of Agriculture, Connecticut Food and Dairy Council, Armour & Company, the State Department of Health, Wheat Flour Institute, and the utility. Program topics included the need of a strong America, value of milk and cheese dishes, inexpensive meat cuts and their preparation, salads for summer and winter, sugar-saving tips, preparation of vegetables, meat replacers and eggs, fish, soy beans, hot breads and general meal planning.

The United company sponsored these classes with the primary objective of disseminating the latest ideas on wartime nutrition without exploiting electrical appliances or central station service. It was the belief of the management that the company was in a better position to do this than many other organizations because its two general offices in New Haven and Bridgeport are equipped with good-sized auditoriums, while the utility has a trained home economist in each division. It was also felt that for the duration commercialism has no place in such a kitchen course, not only because salable electrical appliances are scarce but because of the belief that it would be poor taste to attempt to push electric cooking or water heating at this time.

During the week before the first class opened the company ran three newspaper advertisements announcing the course and listing the topics. After this, one advertisement a week was run in the morning and evening papers in the two cities. This, with window displays, was the only promotion the course received. "Class Day," the final meeting, consisted of a quiz by the class on the course. As attendance prizes, the company made up a "Reddy Kilowatt Kitchen Kollege Class Book," with about 200 pages (5½ x 8½ in.), including many blank sheets for recipes, meal notes, cooking data, etc. This was sent to all women attending at least seven lectures, while those with a perfect attendance received a Reddy Kilowatt apron and those at the last class a small composition Reddy Kilowatt hot pad.

The entire course was free of charge. Suggestions sought from class members as to future course material led to requests for information as to where food talked about can be bought, treatment of such topics as children's meals, canning, noon meals, home-made soups, leftovers and poultry preparation. Motion pictures in certain of the lectures were much enjoyed.



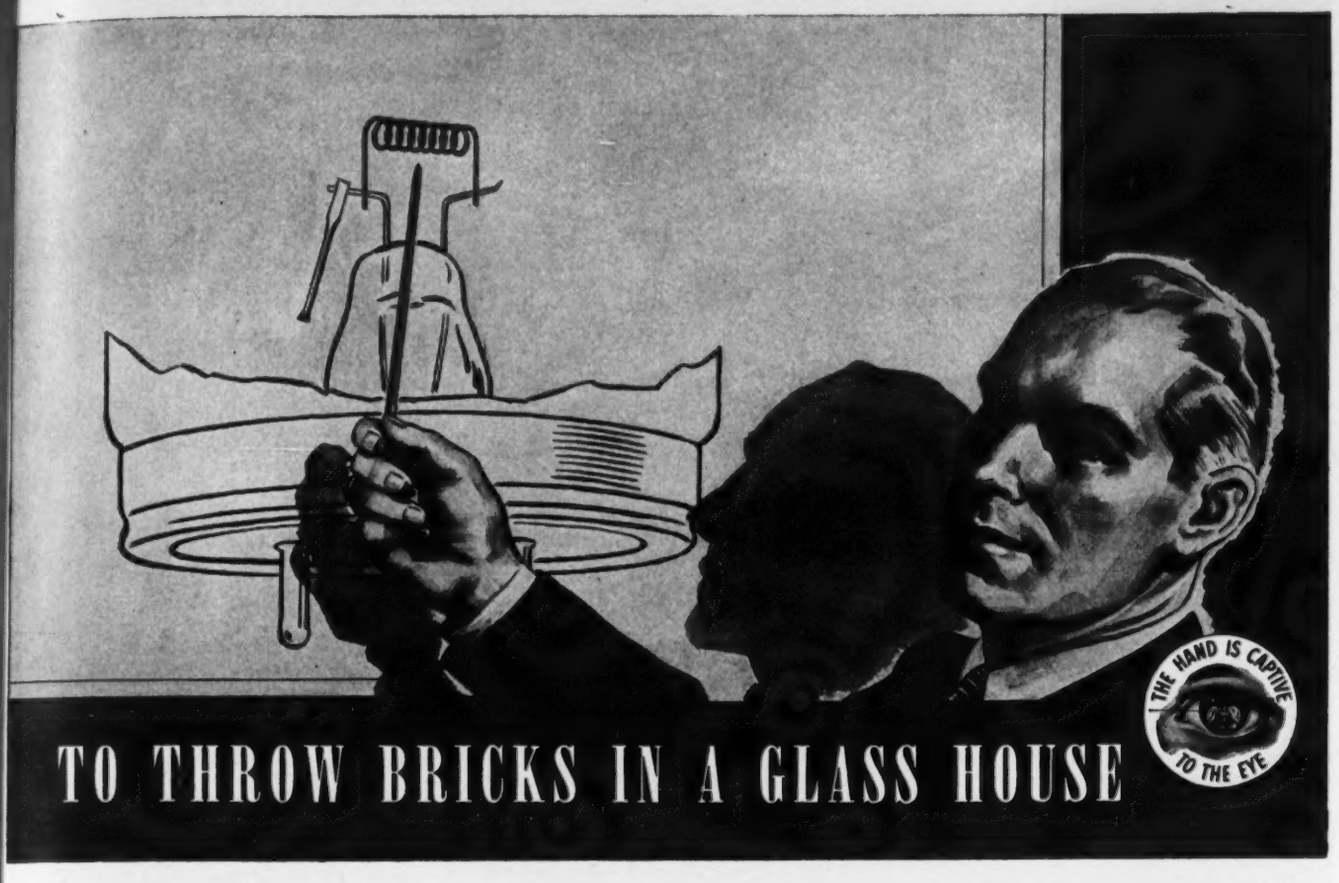
WINDOW DISPLAY at New Haven featuring nutrition course

•

Repair Problems in Rural Service

Replies of 34 REA project superintendents to questionnaires on service conditions in rural areas, sent out by the Minnesota Electric Co-operative of St. Paul, indicate that in many sections repair and maintenance on electrical equipment are serious problems.

Of the 34 REA projects reporting,



TO THROW BRICKS IN A GLASS HOUSE

Hair-fine tungsten, almost invisible to the naked eye until coiled and recoiled, constitutes a cathode. It is coated with a compound which allows it to throw electrons, the bricks of the universe, in the glass house of a fluorescent lamp.

The cathode is a delicate but tough electronic element in the production of fluorescence, which provides the best lighting known for war plants today—and for your home when Victory is won.

At the flick of an electric switch, the cathode throws free electrons—billions of them—into the low-pressure mercury-argon vapor inside the lamp. Free electrons batter mercury atoms, throwing them off balance electrically and into violent motion. In regaining electrical balance, mercury atoms generate ultra-violet rays. This "Black Light" magically makes the "powdered daylight" coating inside the tube fluoresce in a cool, glarefree, shadowless glow more constant than daylight—and just as kind to the human eyes.

During more than ten years of independent research, Sylvania engineers have led in the development of more efficient, more durable cathodes. Electron-emissive material, which is expended in the process of light-making, largely determines lamp life; therefore its chemical formula and application to tungsten are the subject of tireless study.

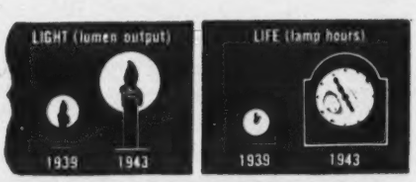
Improvements in material and process specifications are made every week at Sylvania. Many of them, like the "Mercury Bomb" method of precise mercury measurement, conserve strategic materials and labor. But all of them step up fluorescent performance on such counts as lumen output, lamp life, uniform colors, quicker starting—and at progressively lower cost.*

While today's Sylvania Fluorescent Lamps are serving three-shift days in America's war plants, tomorrow's are being made even better. Specify Sylvania replacements for the latest in fluorescent research.

FAR MORE LIGHT AND LIFE FOR YOUR MONEY

*Compared with 1939 a dollar invested today in Sylvania Fluorescent Lamps buys more than four times the lumen output and approximately five times the lamp life.

SYLVANIA FLUORESCENT DOLLAR BUYS:



(Based on decreasing price and increasing efficiency and durability of Sylvania 40-Watt White Fluorescent Lamp)

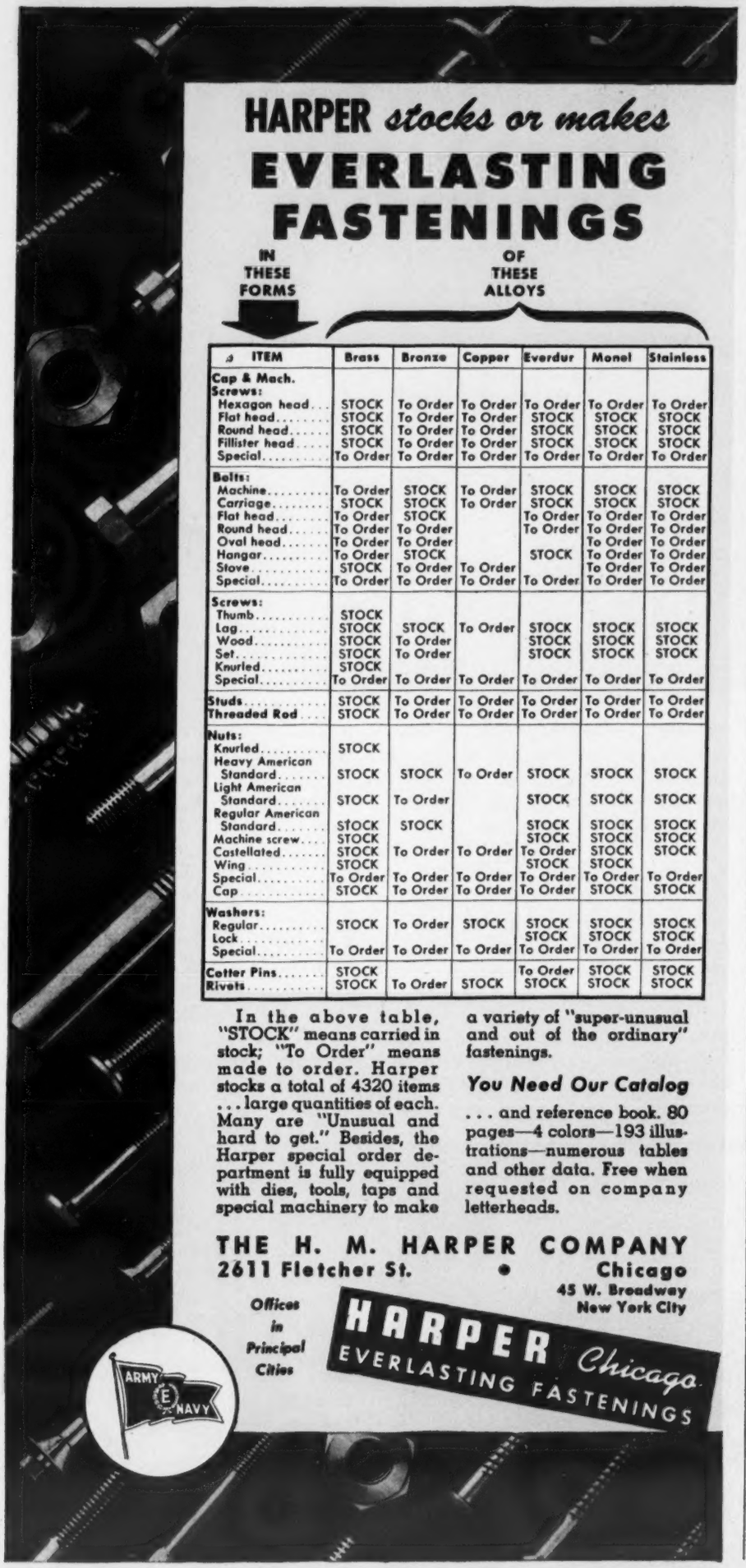
Even on existing circuits, a change-over to fluorescent—Sylvania Lamps, Fixtures and Accessories—will probably more than double the light you get for the same wattage.

SYLVANIA

ELECTRIC PRODUCTS INC.

formerly Hygrade Sylvania Corporation
Salem, Mass.

Incandescent Lamps, Fluorescent Lamps, Fixtures and Accessories, Radio Tubes, Electronic Devices.


HARPER stocks or makes
EVERLASTING FASTENINGS
IN THESE FORMS
OF THESE ALLOYS
ITEM | Brass | Bronze | Copper | Everdur | Monel | Stainless
Cap & Mach. Screws:
Hexagon head | STOCK | To Order | To Order | To Order | To Order | To Order
Flat head | STOCK | To Order | To Order | STOCK | STOCK | STOCK
Round head | STOCK | To Order | To Order | STOCK | STOCK | STOCK
Fillister head | STOCK | To Order | To Order | STOCK | STOCK | STOCK
Special | To Order | To Order | To Order | To Order | To Order | To Order
Bolts:
Machine | To Order | STOCK | To Order | STOCK | STOCK | STOCK
Carriage | STOCK | STOCK | To Order | STOCK | STOCK | STOCK
Flat head | To Order | STOCK | | To Order | To Order | To Order
Round head | To Order | To Order | | To Order | To Order | To Order
Oval head | To Order | To Order | | | To Order | To Order
Hangar | To Order | STOCK | | STOCK | To Order | To Order
Stove | STOCK | To Order | To Order | | To Order | To Order
Special | To Order | To Order | To Order | To Order | To Order | To Order
Screws:
Thumb | STOCK | | | | | |
Lag | STOCK | STOCK | To Order | STOCK | STOCK | STOCK
Wood | STOCK | To Order | | STOCK | STOCK | STOCK
Set | STOCK | To Order | | STOCK | STOCK | STOCK
Knurled | STOCK | | | | | |
Special | To Order | To Order | To Order | To Order | To Order | To Order
Studs | STOCK | To Order | To Order | To Order | To Order | To Order
Threaded Rod | STOCK | To Order | To Order | To Order | To Order | To Order
Nuts:
Knurled | STOCK | | | | | |
Heavy American Standard | STOCK | STOCK | To Order | STOCK | STOCK | STOCK
Light American Standard | STOCK | To Order | | STOCK | STOCK | STOCK
Regular American Standard | STOCK | STOCK | | STOCK | STOCK | STOCK
Machine screw | STOCK | | | STOCK | STOCK | STOCK
Castellated | STOCK | To Order | To Order | To Order | STOCK | STOCK
Wing | STOCK | | | STOCK | STOCK | |
Special | To Order | To Order | To Order | To Order | To Order | To Order
Cap | STOCK | To Order | To Order | To Order | STOCK | STOCK
Washers:
Regular | STOCK | To Order | STOCK | STOCK | STOCK | STOCK
Lock | | | | STOCK | STOCK | STOCK
Special | To Order | To Order | To Order | To Order | To Order | To Order
Cotter Pins | STOCK | | | To Order | STOCK | STOCK
Rivets | STOCK | To Order | STOCK | STOCK | STOCK | STOCK
In the above table, "STOCK" means carried in stock; "To Order" means made to order. Harper stocks a total of 4320 items . . . large quantities of each. Many are "Unusual and hard to get." Besides, the Harper special order department is fully equipped with dies, tools, taps and special machinery to make a variety of "super-unusual and out of the ordinary" fastenings.
You Need Our Catalog
. . . and reference book. 80 pages—4 colors—193 illustrations—numerous tables and other data. Free when requested on company letterheads.
THE H. M. HARPER COMPANY
2611 Fletcher St. • Chicago
45 W. Broadway New York City
Offices in Principal Cities
HARPER Chicago
EVERLASTING FASTENINGS
ARMY E NAVY

70 percent stated that qualified, reliable service outlets are functioning in their areas. The problem of material, however, threatens continued supply in these areas. While 23 of the 34 reporting superintendents indicate a present supply of service adequate for essential needs, 14 of them said service organizations in their areas are unable to maintain even minimum inventories of repair and maintenance materials.

To the 14 reporting critical material conditions must be added 11 areas which state the situation on service outlets and materials makes it impossible to meet essential needs. Thus in 25 of 34 projects dealers are "unable to obtain or keep in stock a minimum supply of wiring materials for local needs."

On the manpower problem, as it affects continuance of service operations, it was asked in the questionnaire if there were persons available with limited experience who might carry on service work for the duration with special training or special licenses. To this seventeen, or 50 percent, of those reporting said "Yes."

•

Promoting Appliance Repair to Dealers*

By L. M. TAYLOR
General Sales Manager
Mississippi Power & Light Company

To insure the survival of electrical dealers in the service area of the Mississippi Power & Light Company, we started out with two main objectives —persuading dealers to broaden out and handle substitute merchandise, and to get them into the repair business for residential and commercial customers. We did a small amount of advertising, and of course dealers were informed of this and results were passed along to them. We made up and distributed a check list of the many substitute items of merchandise that could be handled by dealers.

Contacts were made with all jobbers and distributors covering our territory, and plans were discussed for the necessity for keeping as many dealers as possible in business through expanding their facilities to take care of the repair and maintenance of equipment. We were able to conduct, through the assistance of

*From paper to Southeastern Electric Exchange.

THERE'S NO MAGIC ABOUT IT!

IT'S JUST *Electronics* AT WORK

AIR CLEANING *By Electricity*

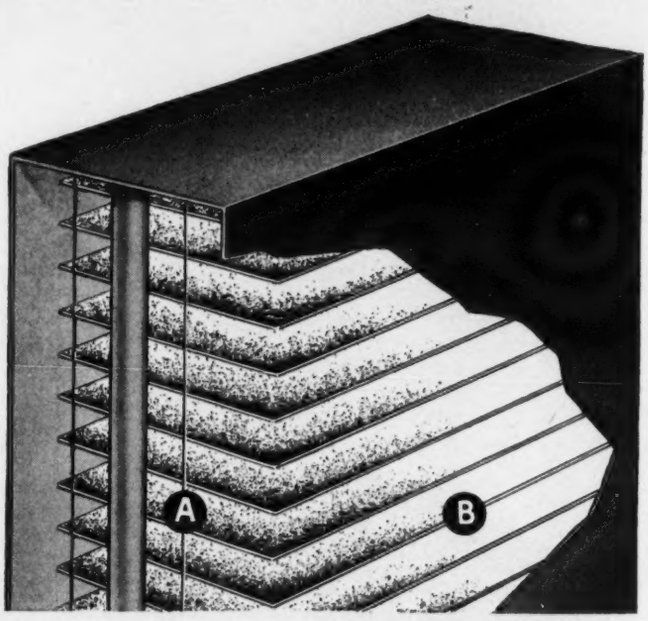
gets more than 90% of ALL particles down to 1/250,000 of an inch

There is no mystery about PRECIPITRON*—the new Westinghouse air cleaner that operates by electricity. Yet it whisks smoke, haze and dirt out of the circulating air as if by magic. Even tobacco smoke, smallest of air-borne particles, is quickly "grounded" by the Precipitron.

Electronics is the secret of Precipitron's exceptional efficiency. Sealed within the ventilating duct so that all air must pass through it, the Precipitron operates silently, effectively, with no more moving parts than a storage battery. At the front of the unit (or cell), two fine tungsten wires and three grounded rods create a strong electrostatic field. As each particle of dust or smoke passes through this field, it receives a positive charge of electricity.

A series of collector plates are located back of the electrostatic field and as the charged particles pass into this area, they are drawn to the oppositely charged plates where they are deposited and adhere. These plates are then cleaned with water and the deposit flushed harmlessly down the drain.

Precipitron's efficiency, far above that of ordinary mechanical air filters, has given a new meaning to industrial air cleaning. For full information write Westinghouse Electric & Mfg. Company, Edgewater Park, Cleveland, Ohio. Ask for folder B-3083.



A. Electrostatic field at the front of the *Precipitron*. Here all dirt and dust particles are given a positive charge of electricity.

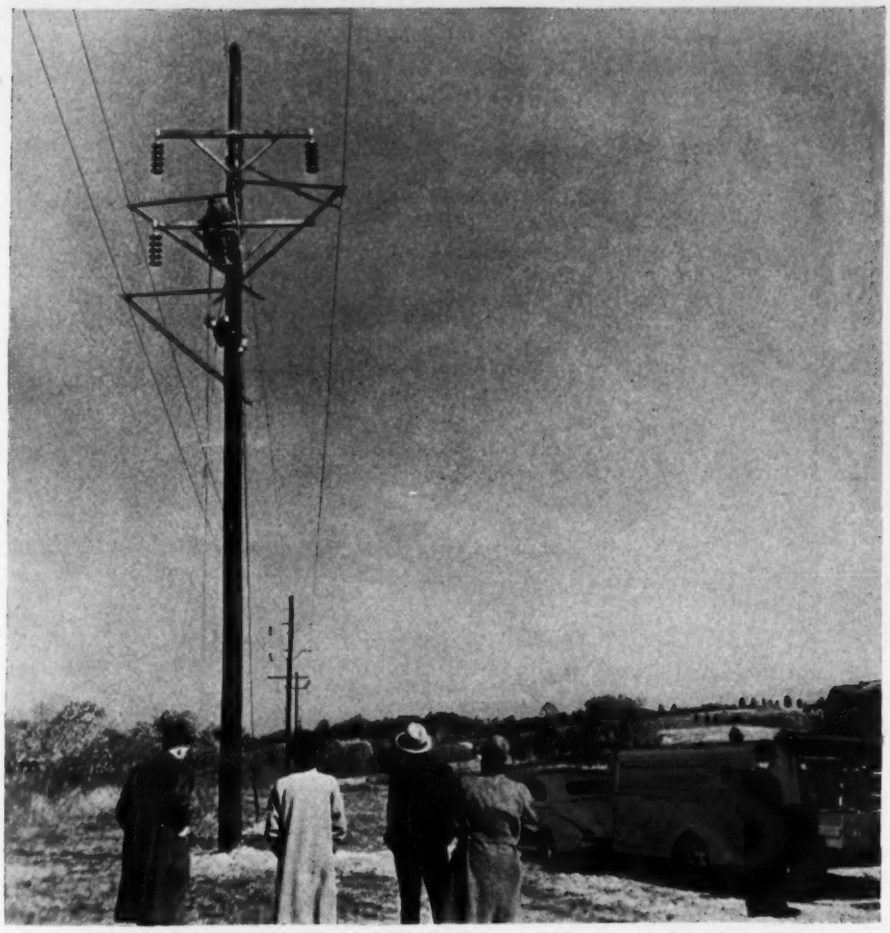
B. Series of collector plates, to which charged dirt particles are attracted and adhere.

*Trade-mark registered in U. S. A.

Westinghouse Precipitron

PLANTS IN 25 CITIES
OFFICES EVERYWHERE

Electronics at Work



Over this peaceful horizon a war plant booms . . .

Only a few miles from here a war production plant is in full operation, while broken insulators are being changed on this 66KV line which furnishes the power. It's on jobs like this where you'll find the Tips Tool demonstrators with their bright orange trailers showing maintenance men how to make repairs in safety without interrupting service and helping them to select the necessary tools.

Most of the Tips Tool demonstrators' time is consumed by Ordnance Plants, Army Posts, Air Bases or Utilities serving essential war industries and although all electrical service is essential to the nation's health we're sure you'll agree that these services must get the first call for demonstration service and equipment.

If you do not happen to serve an Army Post or essential War Industries this may explain why you probably haven't seen one of these demonstration and display units lately. We have tried, however, to contact the utilities in the vicinity of these "essential" calls and will continue to do so. In the meantime consult your Tips Tool Catalog for detailed information about Tips Tools and how to use them. This book will answer most of your questions and when you order we'll do our best to fill the order promptly. Your AA5 will get the tools but, as you know, the special, higher priority orders must be handled first.

CONSULT THIS CATALOG

A·B·CHANCE CO·
CENTRALIA, MISSOURI.
ABC INDUSTRIES

manufacturers and jobbers, repair and service schools throughout the territory for dealers and company personnel.

A dealer directory was made up for the entire territory showing name, address, telephone number, and in some cases the military status, of all repair personnel in our territory. This was furnished to all jobbers in order that they might have a knowledge of where repair work could be secured in our territory.

A jobber and distributor directory was made up showing name and address of all jobbers and distributors covering the territory, together with types of merchandise handled and also the repair parts available through them. This was distributed to all of the 230 repair dealers in our service area.

Directory to Customers

In addition to these things, there was compiled a directory of dealers that do repair work in each company division, and this was furnished to residential and commercial customers—50,000 residential and 12,000 commercial—so that they will have this information readily available when they need repair work. This directory is also used by cashiers in company offices for ready reference in directing customers to repair dealers.

To secure acceptance of the program and cooperation of the dealers the following sales promotion and advertising helps were provided:

The Victory Plan for Appliance and Equipment Dealers—A 16-page booklet was distributed to all dealers in the company's territory and announced the Victory Program to sell dealers on the value of the plan to them.

Dealer Dynamo—The company's dealer paper announced the entire program to the dealers. It contained stories on new ideas, products and other information of value.

Newspaper Advertising — Special newspaper ads stressed the value of care and maintenance of all electrical equipment and urged customers to let the appliance dealers keep appliances working for them. Titles of a few of these ads were: "Keep 'em Working: It Is the Thrifty Thing to Do;" "A Stitch in Time Saves Nine

Nicopress

SUSPENSION DEAD-ENDS

For Use With Disc Insulators On Power Distribution Lines

Do A Mighty Good Job Quickly **AT LOW COST**

And Here Are Some Of The Reasons Why: - - -

- They are strongly made and assembled all in one unit and streamlined to reduce weight.
- Can be speedily and easily installed with the same Nicopress Tools used for line splicing.
- In making the Nicopress Suspension Dead-End the conductors go straight through without bending or distortion. This feature not only assures added strength and length of life of the terminations but also increases to a remarkable degree their power to withstand vibration.
- Provision is made for a tail of any desired length for making jumper connections or tap-offs.
- Completed Suspension Dead-Ends will last as long as the line for they exceed the rated breaking strength of the conductors and are so tight that the wires cannot pull out.
- They are available in a wide range of sizes for copper Copperweld and High Tensile Steel Wire, stranded or solid.

Because of their many time, material and labor-saving features Nicopress Suspension Dead-Ends are by far the most economical way of making open wire terminations.

ORDER FROM YOUR JOBBER

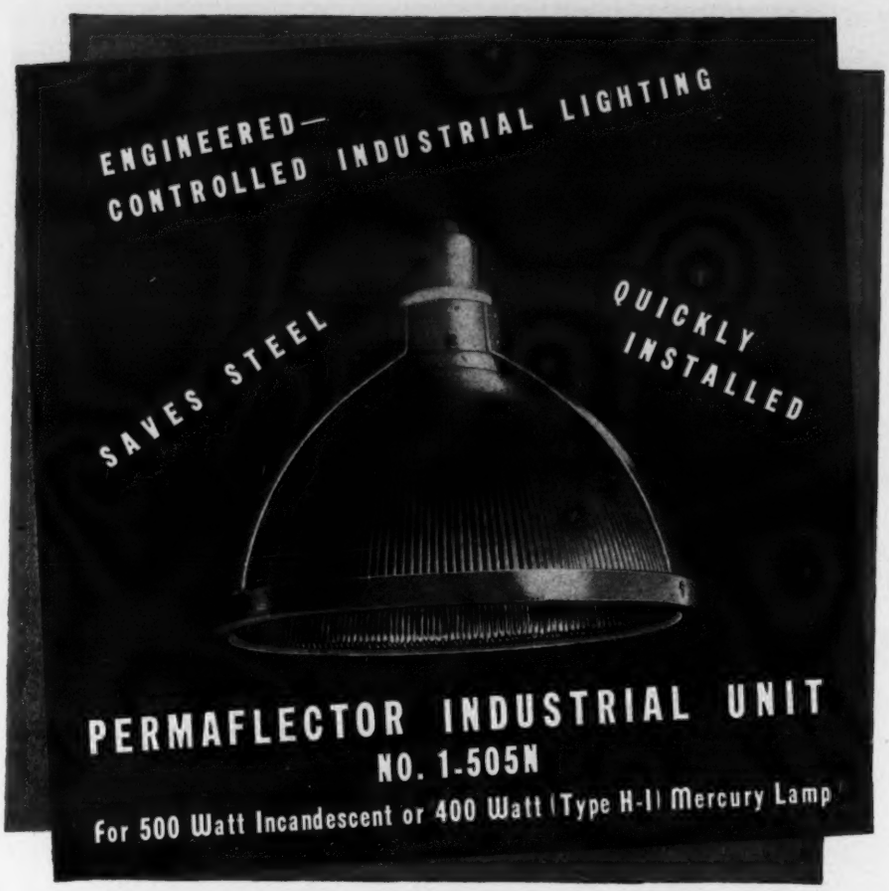
THE NATIONAL TELEPHONE SUPPLY COMPANY

Manufacturer of Specialties for Power and Communication Lines

5100 SUPERIOR AVENUE • • CLEVELAND, OHIO

Canadian Mfr.—N. SLATER CO., LTD., HAMILTON, ONT., CANADA

Export Distributor—INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.



Better Lighting • **More** Lighting per watt over a longer period of time • Flexibility of Installation • Low First Cost • Minimum Maintenance --- these plus factors, proved by years of service in hundreds of installations, establish **Permaflectors** as preferred equipment for industrial lighting.

PERMAFLECTOR
Silvered Glass Reflectors
Put Light Where You Need It --- Want It

Permaflectors are "Shaped Mirrors," that pick up the maximum flux of light and put it where you want it. Over 70 designs provide engineered light control --- for concentrated, intermediate or broad distribution.

PROMPT DELIVERY!

Use GLASS; save Steel! Specify PERMAFLECTORS. Easily, quickly installed in new plants or old without interfering with work flow. Government-specified, Government approved!

PITTSBURGH REFLECTOR CO.

Pittsburgh Permaflector

406 OLIVER BLDG. - PITTSBURGH, PA.

Tear Off

Clip to letterhead. Sign. Mail for complete information. EW-3-43

Applies to the Home Appliances, Too."

Window Display—Special window display posters on appliance repairs were provided dealers for use in their windows and on their counters.

•

"Merchandising" Advertisements

The newspaper advertising program of the Portland (Ore.) General Electric Company for 1943 embodies twice-a-month insertions of large copy in the Portland *Oregonian* and *Daily Journal*, together with 25 other newspapers in the territory. The objective of these advertisements, of which the one shown is typical, is to emphasize the roll which private industries in the Portland territory are playing in wartime activities requiring power, and also the ability of the private utility to serve.

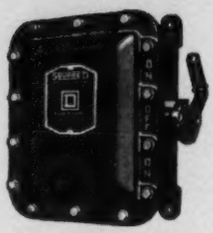
A unique feature is the "merchandising" of these advertisements. Through the co-operation of the various industrial managements with

the utility, whenever an advertisement is to appear telling of the performance or function of a certain plant, every employee of that plant receives a preprint. Sometimes the preprints are folded and given out with the company house organ, or else they are directly distributed.

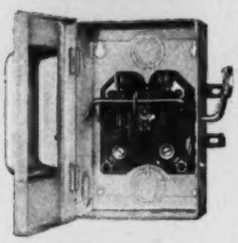
With each preprint goes a dodger, on the front page of which is printed "Salute! to Our War Workers." On the back is a letter directed to the employee over the signature of President James H. Polhemus.

a Complete Line of safety switches

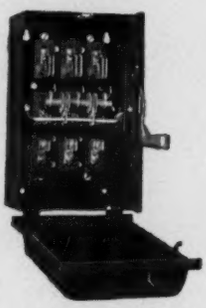
Weatherproof, dust-tight and explosion-resisting enclosures are available with ratings up to 200 amperes. Dust-tight switches approved for Class 11, Group G hazardous locations. Explosion-resisting enclosures approved for Class 1, Group D hazardous location.



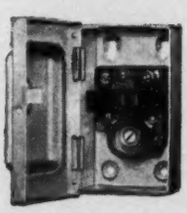
General Purpose Switches (Type D) are quick break only in capacities from 60 to 600 amperes inclusive. Thirty-ampere (and rain-tight) switches are not quick break. Made with 2, 3 and 4 pole and 2, 3, 4 and 5-wire s/n systems. 230 volt A.C. and 250 volt D.C.



Type A Switches with visible blades. Quick make, quick break and interlocked cover; rated from 30 to 2400 amperes, up to 600 volts. Horsepower rated. Fusible and not fusible. 2, 3 and 4 poles and 3, 4 and 5-wire, solid neutral.



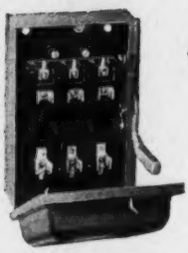
Blue Label Line—Type D Switches are compact, employing a rotary type of blade construction. Made for 2 pole and 2-wire and 3-wire, 230 volt A.C.-250 volt D.C. systems. Available for 30 to 60 ampere fusings. Front operated.



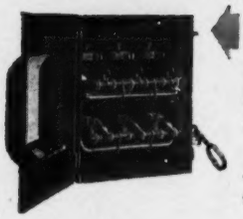
CALL IN A SQUARE D FIELD ENGINEER

If you have a problem which involves electrical control or distribution, you're welcome to the counsel of the nearest Square D Field Engineer. He is in constant contact with plants of every kind and size. He studies methods and applications with the idea of simplifying new jobs or doing old ones better.

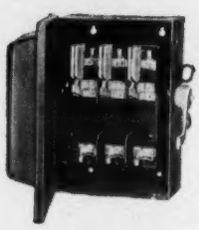
There are Field Engineers in Square D branch offices in 52 principal United States and Canadian cities. Their services are dedicated to solving industry's war and postwar electrical problems.



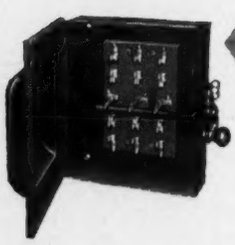
Type A Switches with concealed blades. Quick make, quick break and interlocked cover. Design permits smaller boxes with plenty of wiring space. Up to 200 amperes, 600 volts. H.P. rated. Made in 2 and 3 pole, 3 and 4-wire solid neutral.



Manual Motor Starters are available up to 60 amperes, 575 volts A.C. horsepower rated. Auxiliary blades shunt running fuses when operating handle is moved to starting position. Releasing handle automatically moves blades to running position with fuses in circuit.



Type C Industrial Safety Switches are quick make and quick break. Made up to and including 600 amperes, 600 volt. Fusible and not fusible. Horsepower rated. 2, 3 and 4 poles, and 3, 4 and 5-wire solid neutral. Also available in rain-tight enclosures.



Double Throw Switches. Made in sheet steel or explosion-resisting enclosures, approved for Class 1, Group D hazardous locations. Interlocked covers and quick make and quick break mechanism in sheet steel enclosures.

SQUARE D's unusually complete line of safety switches covers five divisions: *1.* Heavy Duty Industrial Type A. *2.* Intermediate Industrial Duty Type C. *3.* General Purpose (Type D). *4.* Double Throw Switches. *5.* Manual Motor Starters.

The predominance of Square D switches throughout industry speaks volumes for their performance.

SQUARE D COMPANY

DETROIT - MILWAUKEE - LOS ANGELES

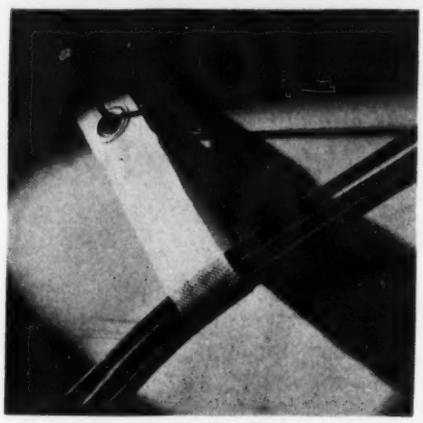
KOLLSMAN INSTRUMENT DIVISION, ELMHURST, NEW YORK

IN CANADA: SQUARE D COMPANY CANADA LIMITED, TORONTO, ONTARIO

NEW EQUIPMENT

Cable Hanger

Designed for use in mines, shipyards and on construction projects, new glass fiber cable strap is available to hold cables



Glass fiber cable hanger; supports approximately 200 lb.; standard size, 14 x 1½ in. **Westinghouse Electric & Mfg. Co.**, East Pittsburgh, Pa.

off floor and ground and thus prevent their being damaged. One-half inch metal grommet in each end permits nailing to wooden pillars. Straps may be used to support cable as shown, or they may be wrapped around cable to prevent slippage. Said to be impervious to moisture, rot, stretching or shrinking, the glass fibers are insulation-treated with a heat-resisting varnish.

•

Electrode Holder

Designed for welding operations in the electrical field, new arc welding electrode holder is made of special high conductivity copper alloy and has mechanical or solder cable connection. Insulated, it is said to protect welder's eyes against flash and eliminate work spoilage which results when a bare type holder contacts the weld.

Model "F-1" electrode holder; takes rods up to 3/16 in., has rated capacity of 200 amp., weighs 12 oz., over-all length 7⅞ in. **Jackson Products**, Detroit, Mich.

•

Floodlight

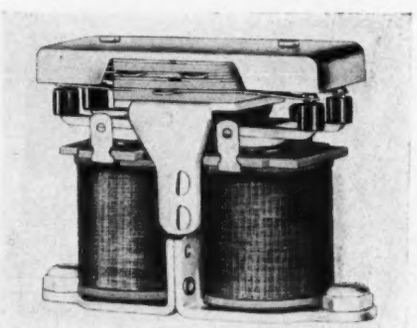
"Circulite" portable floodlight; either 300- or 500-watt lamps accommodated and clear convex or stippled convex diffusing heat-resistant lenses are available. **Steber Manufacturing Co.**, 2451 N. Sacramento Ave., Chicago, Ill.

Floodlight assembly is said to be adjustable in a vertical range from bottom to top of a 6-ft. pipe standard at any angle horizontally and at 360 deg. radius. It has a cast-iron circular base of 20-in. diameter to provide stable footing yet permit portability. The 12-in. reflector is chromium plated.

•

Relay

Available in various contact arrangements or with Micro switches in place of spring pile-ups, new relay is a double-action interlocking control unit with balanced armature control.

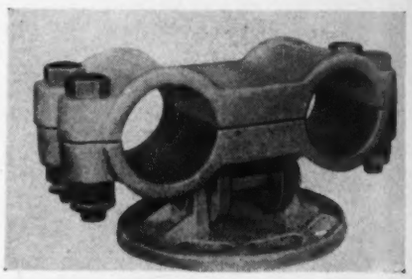


"Balanced armature" relay; capacities up to 5 amp., 110 volts a.c. rating; coil capacity 10,000 ohms each; contact forms or assemblies up to twelve springs on each side. **Cook Electric Co.**, 2700 Southport Ave., Chicago, Ill.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Bus Support Clamp

Cast-to-size single- or double-bus support clamps are available with provisions for longitudinal movement of bus conductors due to expansion or contraction. Bus



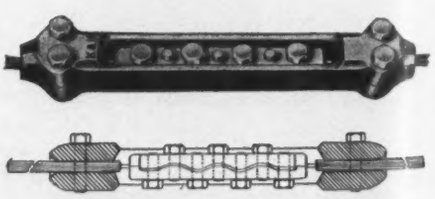
Expansion type bus support clamp. **Delta-Star Electric Co.**, 2400 Block, Fulton St., Chicago, Ill.

fittings have rollers permitting ¾-in. longitudinal movement of bus on either side of center line or a 1½-in. total movement. Use of sliding type of fitting is said to reduce possibility of insulator breakage on long bus runs.

•

Connector

Bolt-pressure type connectors have been designed for the straight connection of aluminum conductor cable comprised of one hard steel wire surrounded by aluminum strands. Connectors consist of two separate members, one of bronze clamping the steel core, the other of aluminum enveloping it and connecting the aluminum stranding. It is said that the joints will withstand a tensile strain equal to the graded tensile strength of the cable itself without injury to the cable and without causing a noticeable millivolt drop.



"Series 5006" to "5022" straight connectors; sizes for No. 4 to No. 4/0 cable. **Krueger & Hudepohl**, S.E. Vine at Third St., Cincinnati, Ohio.

KEEP THIS MAN IN MIND!

He will be knocking on your door with added emphasis when victory is ours. At present, he is doing his best to serve you in spite of a scarcity of materials, an all-out effort on war production and reduced traveling facilities. Some day, these contributions will have proved that they were not in vain, and his familiar voice will have a new and light-hearted tone as he greets you with the latest developments that have been accumulating in the Hubbard Research and Development Department.

For he is a Hubbard Sales Engineer, ready and willing to help you with your present problems, within the scope of war-time limitations. *His* mind is on the application of new Hubbard products to your future operation. Keep him in *your* mind.

HUBBARD AND COMPANY

PITTSBURGH ... OAKLAND CALIFORNIA ... CHICAGO

Protection to life and property and the correct functioning of nearly all types of electrical equipment depend largely on suitable and permanent ground connections—connections that are maintained in a condition to perform the service for which they were designed and installed.

Make sure that your grounds have adequately-low resistance through the periodic use of a "Megger" Ground Tester. These instruments provide a method that is simple, quick and accurate—proved by their acceptance and years of service throughout industry.

★

If you are in need of a really good ground testing instrument, we suggest that you write us immediately. Catalog 1645-W.

James G. Biddle Co.

1211-13 ARCH STREET *Electrical and Scientific Instruments* PHILADELPHIA, PA.

TECHNICAL LITERATURE

CHROMIUM STEELS—"Tables of Data on Chemical Composition, Physical and Mechanical Properties of Wrought Corrosion-Resisting and Heat-Resisting Chromium and Chromium-Nickel Steels" includes 21 extensive tables and 26 charts and curves on the respective steels. Copies of the 44-page pamphlet can be obtained from American Society for Testing Materials, 260 South Broad St., Philadelphia, Pa.; price $1.25 per copy.

INDUCTION HEATING—High frequency induction heating for localized surface hardening, metallurgical results, details of equipment and operation, are presented in a booklet, "Surface Hardening By Induction," available from the Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio.

PORTABLE DRILLS—Handbook covers assembling of portable electric drills, switch control, drill chucks and bits, how to use the drill, and points on user maintenance and control. Copy of "The Drill Use Book" may be secured from the advertising department, Black & Decker Mfg. Co., Towson, Md.

FIRE EXTINGUISHER—Detailed explanation of Waterfog, application of Waterfog for extinguishing fires, and illustrations of installed Waterfog systems are presented in "WaterFOG Fire Protection Systems," a booklet obtainable from Rockwood Sprinkler Co., 38 Harlow St., Worcester, Mass.

COMBUSTION CONTROLS—Manual "Selecting Controls for Fuel Conservation" explains in everyday terms as they apply to five different types of firing, the fundamental rules and formulas which govern the proper burning of fuel and the utilization of heat created; also offers suggestions for the selection of equipment. Copy of the 16-page publication may be obtained from the Hotstream Heater Co., Combustion Equipment Division, 8007 Grand Ave., Cleveland, Ohio.

CENTRIFUGAL PUMPS—Maintenance guide makes specific recommendations for putting pump care on a wartime basis. "Handbook for Wartime Care of Centrifugal Pumps" is a 24-page well illustrated publication available from Allis-Chalmers Mfg. Co., Milwaukee, Wis.

BRAZING—Technique of silver brazing steel terminal tubes to steel inclosures as in marine construction, using silver alloy wire and flux paste (Easy-Flo and Handy Flux), is outlined in bulletin "Easy Flo Rings," made available by Handy & Harman, 82 Fulton St., New York, N. Y.

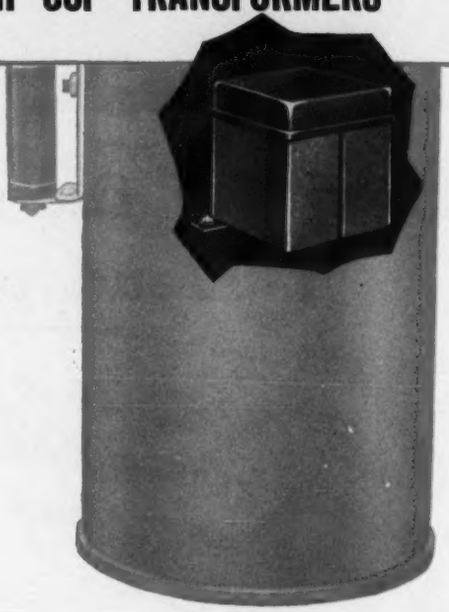
BUSES—Electrical and mechanical factors of a fundamental nature in the design of current-carrying members and supporting structures for buses are reviewed in "Electrical Buses and Bus Structures." A copy of the 24-page book by William Deans, chief engineer I-T-E Circuit Breaker Co., may be obtained by addressing your request to the company at 19th and Hamilton Sts., Philadelphia, Pa. A series of articles adapted from the book began in Electrical World, December 26, 1942 issue.

ONE ANSWER

TO 3 QUESTIONS ABOUT TRANSFORMERS

1. How can heavier loads be handled?
2. How can this equipment be protected against loss?
3. How can service interruptions be reduced?

LOADING BY COPPER TEMPERATURE (L.C.T.) WITH CSP TRANSFORMERS



The answer to these questions is based on this fact: **Loading by Copper Temperature (L.C.T.) increases usable transformer kv-a by 25% to 40% —with complete safety!**

1 **L.C.T.** puts the reserve thermal capacity of a transformer to work. Emergency overloads can be carried longer, without danger, right up to the thermal limit of the windings.

2 **L.C.T.** gives sure protection against burnouts—positively disconnects a dangerous overload before windings can be damaged.

3 **L.C.T.** provides a visible indication of dangerous overload conditions so that load can be arranged, if necessary, to avoid power "blackouts."

Ask your Westinghouse engineer to give you the facts about this transformer development. He'll be glad to submit definite recommendations . . . glad to help you get more out of your transformer applications. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., Dept. 7-N. J-70398

TRIPLE ACTION

FOR PROTECTING TRANSFORMERS

MEASURES **the amount of overload.** Loading by Copper Temperature uses *actual* winding temperature, takes into consideration load duration and magnitude.

SIGNALS **approach of thermal capacity.** Unnecessary interruptions of service are avoided because a red warning light flashes when dangerous winding temperature is being approached.

DISCONNECTS **load from transformer.** If overload actually becomes dangerous, an internal circuit breaker *automatically* removes the load from the transformer.

Westinghouse

PLANTS IN 25 CITIES ... OFFICES EVERYWHERE

CSP TRANSFORMERS

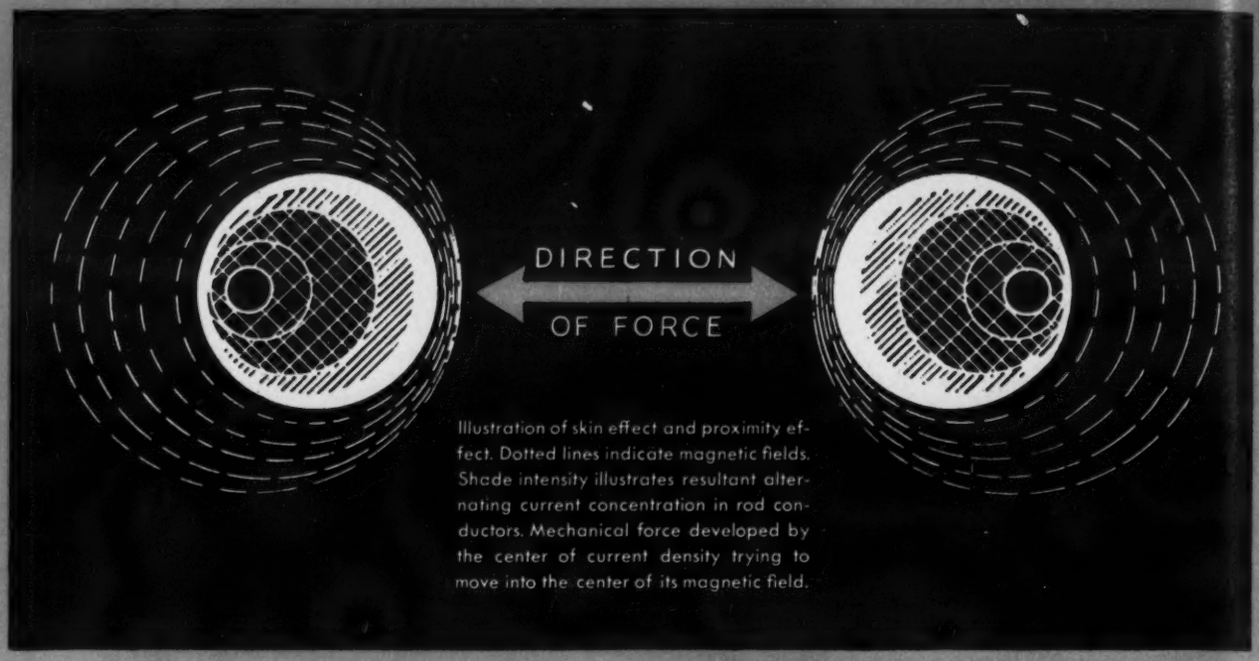


Illustration of skin effect and proximity effect. Dotted lines indicate magnetic fields. Shade intensity illustrates resultant alternating current concentration in rod conductors. Mechanical force developed by the center of current density trying to move into the center of its magnetic field.

Don't let the size of a conductor mislead you on capacity

What counts is a design "tailor made" to meet operating conditions—

Skin effect and proximity effect, shown in the above sketch, are but two factors which must be considered in bus design. Anaconda Publication C-25, sent free on request, discusses these and other problems, and graphically describes operating characteristics of different types of bus structures.

Although its high conductivity and consequent low current loss is the outstanding electrical characteristic of copper, there are other properties which make copper so well suited to more efficient bus constructions: high thermal conductivity, high strength, high resistance to corrosion and ready availability of accessory equipment.

Wherever modern electrical engineering practice dictates bus construction embodying structural strength, low ohmic and reactance losses or effective heat dissipation, the range of copper bus shapes made by The American Brass Company will meet every requirement, for, in addition to a complete line of copper bus bars of rectangular shapes, this Company makes high conductivity pipe and tube, stranded cables and special shapes—as well as channels and angles for the construction of hollow ventilated busses. 48100

ANACONDA

Anaconda Bus Conductors

THE AMERICAN BRASS COMPANY, General Offices: Waterbury, Connecticut

Subsidiary of Anaconda Copper Mining Company • In Canada: ANACONDA AMERICAN BRASS LTD., New Toronto, Ontario

NEWS ABOUT PEOPLE

Arch Robison Joins Staff of Cincinnati Gas

Arch Robison has been appointed manager of the Middletown division of the Cincinnati Gas & Electric Co., to succeed L. E. Marshall, who is retiring after 27 years of service in the position and a total of 42 years in the utility business. Mr. Robison brings to his new position a long and varied experience in engineering and management. Before his assignment in Middletown Mr. Robison was in North Carolina, where he held the position of general manager on design and construction of an $11,000,000 naval munitions plant.

He served as city manager of Celina, Ohio, in charge of the municipally owned electric and water utilities and other departments of that city. For nine

Arch Robison

years he was vice-president and general manager of an electric public utility and transportation system in northern Ohio, with headquarters at Findlay and Wooster. He held various positions with utility companies in Montana for ten years. Service with the state of Ohio occupied Mr. Robison's attention for three years, during which time he was chief engineer of the Public Utilities Commission of the state of Ohio.

With Sanderson & Porter, the J. G. White Engineering Corp., United Engineers & Constructors and Charles T. Main, Inc., of Boston, he had broad experience supervising numerous industrial and power plant installations. In his new position, he will supervise the operations of the company's gas and electric service systems in Middletown, Hamilton, Franklin, Oxford and their surrounding territories.

•

California Edison Assigns New Duties

A number of Southern California Edison Co. district managers have recently been assigned to new fields.

William P. Graef is now an executive assistant of the company, remaining as special representative of the management in Long Beach, where he has been district manager for thirteen years.

John H. Mead, formerly assistant district manager of Long Beach, is now district manager.

H. A. Brody, formerly Montebello district manager, has been assigned to the Huntington Park district as manager, succeeding A. I. Whitehead, retired.

P. V. Moffat, formerly Redlands district manager, is now district manager at Montebello.

H. J. Moulton, formerly San Bernardino district manager, is now district manager at Redlands.

R. J. Doyle, formerly San Bernardino assistant district manager, is now district manager.

•

▶ DANIEL F. BARNARD, formerly of the Champion Lamp Works, Lynn, Mass., has been appointed sales manager of Federal Electric Products Co., Newark, N. J.

Southern Indiana Utility Promotes A. B. Brown

A. B. Brown has been appointed general superintendent of the gas and electric operations of the Southern Indiana Gas & Electric Co., Evansville.

Mr. Brown was graduated from Mon-

tana State College in 1923 and spent one year with the Westinghouse Electric & Manufacturing Co. at East Pittsburgh, Pa., before becoming associated with the utility industry.

He joined the Ohio Edison Co., Springfield, Ohio, in 1924, and was transferred to the Southern Indiana Gas & Electric Co. in 1926 as test engineer. In 1929 the Ohio River station of the company was completed and Mr. Brown was made chief engineer, with the responsibilities of organizing the plant personnel and putting the station in operation. In 1932 he was made superintendent of electric production and as such supervised the operation and construction of generating stations and major substations.

•

▶ CHARLES L. HENDERSON has resigned as superintendent of operating practices

"Shutdowns Ended

at Hercules Foundries, Inc., After

Read This, IF YOU HAVE PRODUCTION TROUBLES

"About a year ago, Hercules Foundries Inc., 5950 S. Boyle Ave., Vernon, Calif., complained that frequent fuse blows were shutting down their ball mill and interfering with production.

"We investigated and found that the 50 ampere fuses they were using were the proper size to use—but they that blew on surges and momentary overloads.

"We figured that if the fuses had a longer time-lag they would be all right. 50 ampere BUSS Super-Lag fuses were then installed.

"They put an end to these shutdowns and Hercules Foundries haven't any more such production losses."

L. J. Meller,
Meller Electric Company,
Huntington Park, Calif.

BUSS

On This Ball Mill we Installed BUSS FUSES"

Says Electrical Contractor L. J. Meller of Huntington Park, Calif.

THERE'S a profitable moral in Mr. Meller's experience at Hercules Foundries, Inc. It's another example of preventing interruption of production schedules by using Buss Super-Lag fuses. It's definite proof that fuse blowing on harmless overloads is unnecessary and need not be tolerated.

Buss fuses require no maintenance or periodic inspection. They don't open needlessly. If one opens, you can be sure some condition needs correction. When one opens, it requires less than 45 seconds to renew with an inexpensive link.

Here is why BUSS fuses greatly reduce or entirely prevent needless blows

The fuse case is designed to insure good contact on the link, even when the fuse is renewed by an inexperienced person—and it is so designed that vibration or heavy overloads or the constant heating and cooling of the fuse will not permit poor contact to develop. Thus excessive heating which causes fuses to blow needlessly is prevented.

The fuse link used is the famous "BUSS Super-Lag." It has lag-plates attached to it. These give it a long time-lag so that unusually heavy starting current or other harmless overloads will not cause the fuse to blow.

How to solve the "shutdown problem"

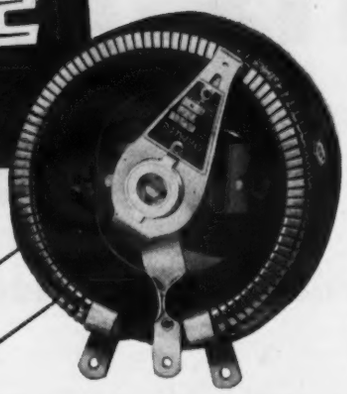
Pass the word along that all purchase records dealing with circuit protective devices should be immediately changed to call for BUSS Super-Lag Renewable fuses. Then, as fuses are replaced or new installations made, your plant will automatically get the benefit of the carefree, trouble-proof protection that BUSS Super-Lag fuses afford.

BUSSMANN MFG. CO., University at Jefferson
St. Louis, Missouri *Division McGraw Electric Company*

10 FEATURES
in the design of the FUSE-CASE help make it possible.
The SUPER-LAG
development in the FUSE-LINK completest he job.

Super-Lag FUSES SOLD THROUGH WHOLESALERS

OHMITE RHEOSTATS

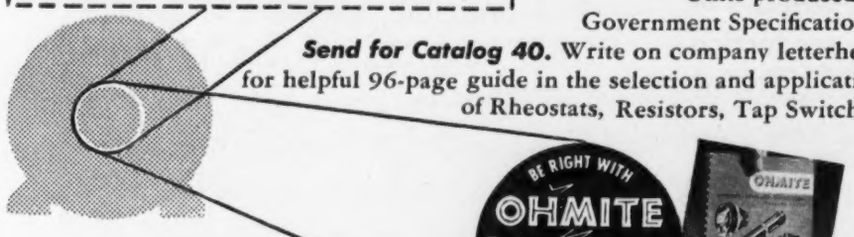


Permanently Smooth Close Control

for Motor Speed, Generator Fields, Lamp Dimming, Electronic Tubes, Welding Apparatus and similar applications.

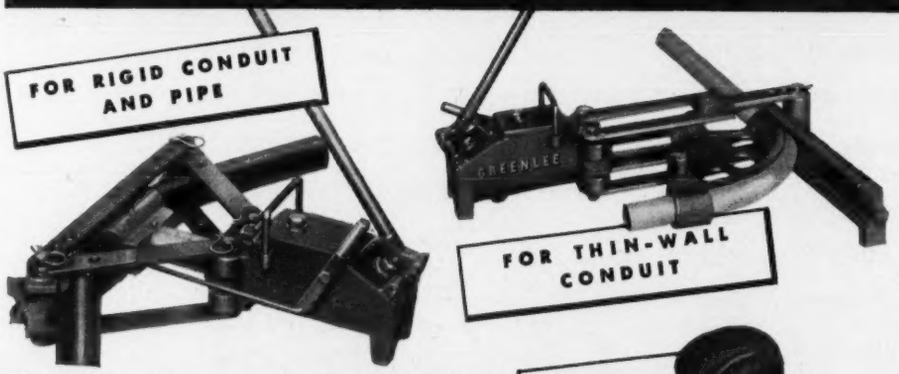
Proved Right—Everywhere!
Wide Range of Types and Sizes.
Units produced to Government Specifications.

Send for Catalog 40. Write on company letterhead for helpful 96-page guide in the selection and application of Rheostats, Resistors, Tap Switches.



OHMITE MANUFACTURING CO.
4849 Flournoy St. • Chicago, U. S. A.

GREENLEE BENDERS
FOR ANY OF YOUR BENDING JOBS



Whatever you have to bend — tubing, conduit, pipe, or bus-bars — there's a Greenlee Bender to do the job easier and faster. Powerful hydraulic benders will bend rigid and thin-wall conduit, pipe, and bus-bars, while small hand benders will handle steel, copper, brass and aluminum tubing. These light, portable benders are compactly built in one unit . . . are easy for one man to operate . . . make smooth accurate bends . . . and eliminate the cost of many manufactured bends and fittings. Write for free bender booklet S-116.

GREENLEE TOOL CO.
1803 COLUMBIA AVE., ROCKFORD, ILL.

for the West Penn Power Co., after 25 years of service, to become sales engineer with the J. Parks Hutcheson Electrical Sales Engineering Co. of Pittsburgh. Mr. Henderson joined West Penn in 1917 as load dispatcher.

•

Reliance Electric Names Taylor Vice-President

S. B. Taylor, works manager of the Reliance Electric & Engineering Co., Cleveland, since 1931, has been elected manufacturing vice-president of the company.

A native of Kentucky and a graduate in electrical engineering in 1924 of Purdue University, Mr. Taylor took an

additional year of post-graduate work in business administration at the University of Illinois before entering the engineering department of Reliance. He transferred to the manufacturing department of the company in 1930 and became works manager a year later. He was elected a director of the company in 1935.

Mr. Taylor is president of the Cleveland branch of the National Metal Trades Association and a member of the association's administrative council.

•

▶ ANDREW H. PHELPS, vice-president in charge of purchases and traffic for the Westinghouse Electric & Manufacturing Co., recently received the Westinghouse order of merit for exceptional service to the electrical industry and his company in wartime.

▶ E. C. EAGLEN has been appointed coordinator of post-war planning for the Oliver Iron & Steel Corp., Pittsburgh, Pa. Mr. Eaglen was formerly sales engineer of pole line materials for Oliver and has had many years of experience in production, engineering and sales. Mr. Eaglen's new duties will embrace

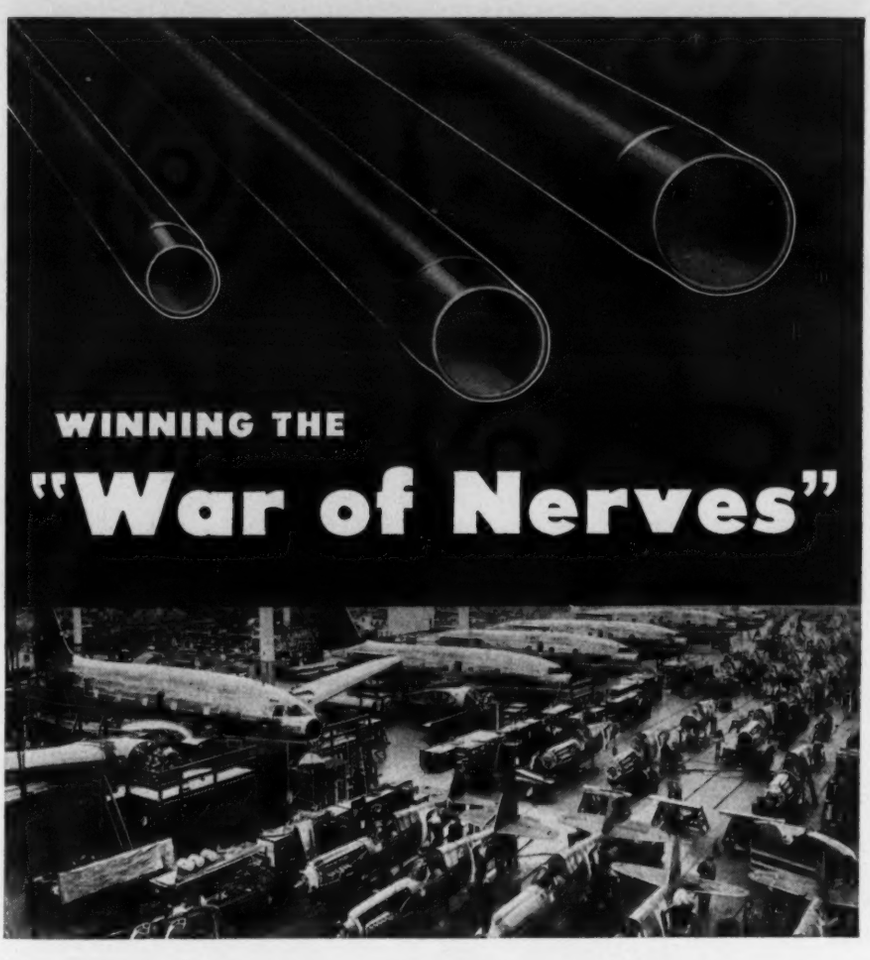
studies of Oliver's present products and manufacturing facilities. In addition, he will investigate new products and new uses for present products, with particular reference to future requirements and conditions. As co-ordinator of post-war activities he will formulate a market development and research plan to guide the engineering and manufacturing departments in the development of new products for manufacture after the war.

▶ H. D. STILLMAN has been appointed assistant division manager of the Huntington division of the Appalachian Electric Power Co. with offices in Huntington, W. Va. Mr. Stillman has been district manager of the Logan district for the past eleven years and has been connected with the power company for the past 20 years, since his graduation from the University of Michigan in 1923.

▶ E. W. FOWLER, industrial lighting supervisor, and C. L. CROUCH, lighting engineer of the Buffalo Niagara Electric Corp., have received the Niagara award from the Illuminating Engineering Society for outstanding studies which will influence the application of light in offices, classrooms and drafting rooms. Collaborating on their paper, "Glare and Lighting Design," the Buffalo men became the first in the nation to win the award.

▶ R. S. NEBLETT, who was assistant manager of General Electric Co.'s turbine division for more than three years, has been appointed assistant manager of the company's federal and marine division. Mr. Neblett has been a General Electric employee since 1923, when he entered the company's test course for student engineers at Schenectady immediately following his graduation from Georgia School of Technology. He joined the turbine division in 1926, became manager of sales of the Schenectady section in that division in 1938, and the following year was named assistant manager of the division. Mr. Neblett is a member of the American Society of Mechanical Engineers and of the American Society of Naval Engineers.

▶ ALBERT W. WHITNEY, who has been for many years one of the most important figures in the safety and standardization movements in the United States, has retired from active service. A vice-president of the National Safety Council for 18 years, Mr. Whitney had been active in the work of the American Standards Association since 1922. When Mr. Whitney was first associated with the work of the American Standards Association, the association was a coordinating committee for standards known as the American Engineering Standards Committee. His influence



● *Every* American war plant is a *"bundle of nerves"*—a complex network of cables and wires. These "nerve centers" supply the plant with light and power, as well as the *vital juice* for its fire, telephone, signal and other forms of internal and external communication.

Today—as never before—the safest place for cable and wire is *underground*—in Orangeburg Conduits.

Orangeburg Fibre Conduit is helping war plants the country over to win the "war of nerves". A *non-critical* material itself, available immediately without priority, it affords complete protection to cable which *is "critical."*

Orangeburg's tapered sleeve joint allows rapid installation and provides tight joints with perfect alignment of raceways. Low friction co-efficient of ducts allows long cable pull even around bends with minimum tension on cable. Interior surface of duct does not score or damage cable sheath when pulling, and the coal tar pitch and fibre surface protects sheath from corrosion at points of contact. Impermeability of conduit and joints prevents infiltration of corrosive elements at all points on the line.

ORANGEBURG STANDARD
encased in concrete, is the most economical construction for duct-banks of four or more ducts.

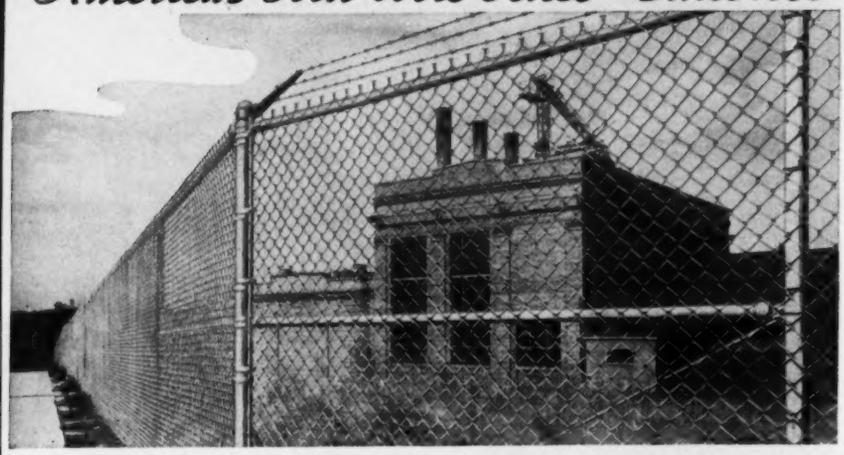
ORANGEBURG NOCRETE
is most economical as it permits installation underground without concrete encasement.

Sales Agent—Distributors
GENERAL ELECTRIC SUPPLY CORP. GRAYBAR ELECTRIC CO., INC.

ORANGEBURG CONDUITS
Made at Orangeburg, N. Y. by The Fibre Conduit Co., 292 Madison Ave., N. Y. C.

PAGE FENCE

America's First Wire Fence — Since 1883



Protect Your Protection!

● Your fence is now "critical material." Because replacement may not be possible for some time to come, you will be wise if you have your present fence inspected now and serviced expertly by Page-trained men. Their long, specialized experience and their knowledge of localized conditions affecting fence metals, qualify them to extend the protective life of your fence. Write for name of nearest Association member and discuss fence servicing with him. Address PAGE FENCE ASSOCIATION, Headquarters: Monessen, Pa.

PRODUCT OF PAGE STEEL & WIRE DIVISION • AMERICAN CHAIN & CABLE COMPANY, INC., BRIDGEPORT, CONN.

Test Insulation the Modern Way
with a MODEL B-5
MEGOHMER

VARIOUS NEW MODELS AND RANGES

NEW BATTERY-VIBRATOR TYPE

No more tiresome cranking of a hand-driven generator . . . Entirely self-contained, steady test potential of 500 volts DC, available at the touch of a switch. Direct reading in insulation resistance.

HERMAN H. STICHT CO., INC.
27 PARK PLACE NEW YORK, N. Y.

WRITE FOR BULLETIN No. 430

ELECTRITE

A high grade fibre board for electrical insulation. A material of quality possessing high tensile and dielectric strength. Used by many of the leading manufacturers of electrical equipment.

DENSITE

An extremely hard board of superior quality which can replace the more expensive types of insulating materials.

Pulp Products Department

WEST VIRGINIA PULP & PAPER COMPANY

played a large part in enlarging th scope of the A.E.S.C. to include wor on safety and to bring government an trade associations into active membe ship. This enlargement of the scope o the committee was the first step whic led to a change in the organizatio from a committee representing onl technical societies to an association i which all groups are represented an made possible the present extensive na tional program of the A.S.A. Whit ney has been a member of the A.S.A Standards Council continuously fro 1922 to the present time. In additio to serving as its chairman from 1922 24, he was vice-chairman last year One of his outstanding contributions t standardization was as a member of th First Pan American Standardizatio Conference, which was held at Lima Peru, in 1924.

► FREDERICK W. JESSER, who retired a secretary of Consolidated Edison Co. i 1940 with a service record of 51 years was elected president of the Edison Pioneers at the recent annual luncheon He succeeded Edwin W. Hammer.

► D. H. O'BRIEN, vice-president of th Graybar Electric Co. in charge of sale activities in the merchandising an Western Electric products department has retired after 26 years of service with Graybar to devote himself entirely to his new work in the Signal Corps Mr. O'Brien will head the new fiel service division of that branch of the Army. Acting in civilian capacity, Mr. O'Brien will supervise the co-ordination of distributing signaling equipment and spare parts and maintenance and re pair activities, in both interior zones and theatres of combat. He will main tain headquarters in the Pentagon Building, Washington, D. C.

► DR. FRANK PARKER, professor o finance at the Wharton School of Busi ness of the University of Pennsylvania has been appointed by Governor Martin of Pennsylvania to succeed Richard J. Beamish as a member of the state Pub lic Utilities Commission, whose term expired after more than eight years with that regulatory body. Dr. Parker served as financial counselor in numer ous public utility and railroad rate and valuation proceedings and will serve for a ten-year term.

► H. M. ROWLETTE has been elected vice-president and general manager of the Whiting Corp. (Canada), Ltd., to succeed Col. James Mess, now devoting full time to government duties at Ot tawa. The Canadian company has been moved to 45 Richmond Street, West, Toronto. Mr. Rowlette has been with the parent company at Harvey, Ill., since 1912 and for many years was in charge of purchases and stores.

NON CRITICAL

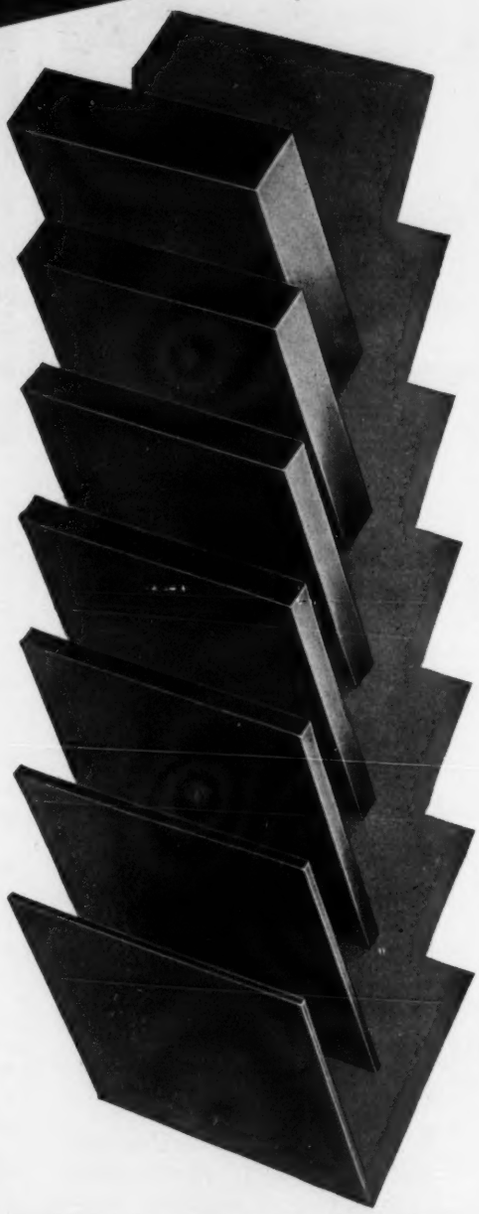
LIGNOLITE

A LAMINATED LIGNIN

PLASTIC

FOR ELECTRICAL INSULATION . . . .

PROMPT SHIPMENT



LIGNOLITE CAN BE USED FOR MOST ELECTRICAL INSULATION NEEDS

Use LIGNOLITE for Clamps and Supports for Busses in Metal Clad Switchgear—Circuit Breaker Bases—Switch Connectors—Insulating Supports—Relay Bases—Switchboards—Panel Boards—Spool Heads—Insulating Washers—to replace Steel in Metal Clad Switchgear—Cabinets to house Electrical Equipment—Name Plates for Electrical Equipment—Terminal Strips, etc.

Use LIGNOLITE where Excellent Electrical Properties or High Mechanical Strength is important

LIGNOLITE has superior arc resistance—high dielectric strength—low moisture absorption—high resistance to oil, grease, and dilute acids—high strength-weight ratio which combines to give you dependable, permanent electrical insulation.

LIGNOLITE is available in black color with either a satin or molded sand blast finish. The following sizes are now produced—46-inch x 46-inch and 28-inch x 72-inch sheets in thicknesses from 1/64-inch to 5/8-inch inclusive and 40-inch x 40-inch sheets in thicknesses over 5/8-inch to 2-inch inclusive. Also available—fabricated parts to your specifications. Details will be supplied on request.

SAMPLE SENT Free . . . .

A Sample of LIGNOLITE will be sent to you so that you can personally test it. WRITE TODAY and ask for BULLETIN that tells about the properties, characteristics, and methods of fabricating and using LIGNOLITE.

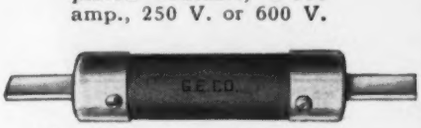
MARATHON CHEMICAL COMPANY

Div. of Marathon Paper Mills Co.

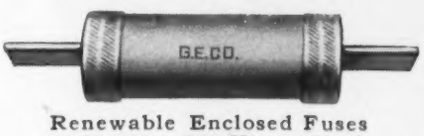
ROTHSCHILD WISCONSIN

PROTECT EQUIPMENT WITH G-E FUSES

Silvend Fuses (silver-plated contacts) 3-600 amp., 250 V. or 600 V.



Non-renewable Enclosed Fuses 1-600 amp., 250 V. or 600 V.



Renewable Enclosed Fuses 3-600 amp., 250 V. or 600 V. (Renewal links available)

G-E Fuses provide reliable overload and short-circuit protection for all electrical circuits . . . protect war-busy electrical equipment. These fuses are made of the best materials. They are thoroughly tested and accurately rated.

G-E Silvend Fuses have silver-plated contacts. They are designed for use with apparatus having silver-plated fuse contacts. Heating due to oxidation does not occur with this combination. *Apparatus with silver-plated fuse contacts needs these fuses for best results.*

For further information see the nearest G-E Merchandise Distributor or write to Section D-332-9, Appliance and Merchandise Department, General Electric Company, Bridgeport, Conn.

GENERAL ELECTRIC

OBITUARY

Max W. Babb

Max W. Babb, chairman of the board of directors of Allis-Chalmers Manufacturing Co., Milwaukee, Wis., died on March 13 in Columbia Hospital, after an illness of a month. He was 68 years of age.

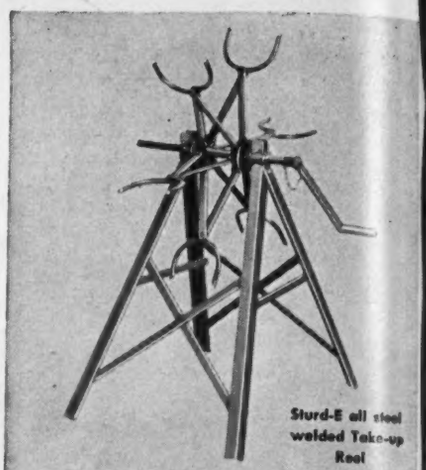
A native of Mount Pleasant, Iowa, and a graduate of Iowa Wesleyan College and of the University of Michigan

law department, he entered the practice of his profession in his native city. In 1904 he was appointed attorney for Allis-Chalmers Co. and moved to Chicago. Some time later he went to Milwaukee. He became vice-president and general attorney of the manufacturing company during its reorganization in 1913. In 1932 he was elevated to the presidency, succeeding Gen. Otto Falk, who became chairman of the board. Mr. Babb held the presidency until January, 1942, when he was made chairman.

In 1930 he was named a director of the Federal Reserve Bank for the Seventh (Chicago) district and had been a director of Cutler-Hammer, Inc., since 1938.

•

▶ Martin Schiff, chief engineer of the Century Electric Co., St. Louis, died suddenly on February 15. Mr. Schiff was born in New York in 1890 and was graduated from Cornell University in 1912. Before joining the Century organization in 1933 he had previously been employed as a test engineer at Diehl Manufacturing Co., Elizabeth, N. J., from 1912 to 1913; assistant engineer of the Ideal Electric & Manufacturing Co., Mansfield, Ohio, from 1913 to 1916; was in charge of a.c. design at the Electro Dynamic Co., Bayonne, N. J., during 1920; chief engineer of



Sturd-E all steel welded Take-up Reel

Exclusive in
VALUE—UTILITY *and* LIFETIME SERVICE

Sturd-E Reels are exclusive in all welded steel construction. Result—in service life, value, and ease of use, they are unmatched.

The Sturd-E Take-Up Reel is collapsible for ease in transporting. All steel construction —electric welded throughout —adds value that is unequalled.

The Sturd-E Pay-Out Reel is quickly adjustable to accommodate any of the various sized bales of wire. All welded steel construction assures lifetime value. Quickly attached to back end of trucks.

Specify Sturd-E Reels for all service—to obtain the tops in value and utility.

STURD E TOOLS
a TRUE TEMPER PRODUCT

Sturd-E all steel welded Pay-out Reel

Distributed by
JOSLYN MFG. & SUPPLY COMPANY
Executive Offices
20 North Wacker Drive • Chicago, Illinois
Branches and Warehouses with Complete Stocks in Principal Cities of the United States

Roth Bros. & Co. from 1920 to 1929, and as assistant chief engineer and assistant to the president of the Imperial Electric Co., Akron, Ohio, from 1929 to 1933. Mr. Schiff was a fellow of the A.I.E.E.

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Richard De Wolfe Brixey

Richard De Wolfe Brixey, president and treasurer of the Kerite Insulated Wire & Cable Co., New York, died March 14 at his home in that city, in his sixty-third year. Mr. Brixey had been associated for 40 years with the Kerite organization.

He was born in Seymour, Conn., and after graduating from the Sheffield Scientific School of Yale University in 1902 he returned to Seymour to begin there his career with Kerite. Later he transferred to New York as general manager.

•

▶ OLIN LONGINO, for 28 years head of the land department of the Arkansas Power & Light Co., and who personally acquired much of the right-of-way for the company's large interconnected system, died at Hot Springs, Ark., on February 25. He was 68 years of age. His survivors include a brother, J. Leland Longino, retired vice-president of Arkansas Power & Light Co., and one of the men associated with the late Harvey Couch, long-time president of the company, when he got into the industry in 1913.

▶ DAY BAKER, 80, a former associate of Thomas A. Edison in the development of storage batteries, and later a leading figure in the promotion of electric industrial and road trucks in New England as head of the Electric Motor Car Club of that area, died at a Boston hospital on March 4. In recent years, following his withdrawal from the post of manufacturers' representative at Boston, he had been a legislative agent for various motor vehicle associations at the Massachusetts State House.

▶ WILLIAM T. RYAN, division manager of the Main Line division of the Philadelphia Electric Co., died on March 7 in the Abington Memorial Hospital, following an emergency abdominal operation. A graduate of the U. S. Naval Academy at Annapolis, Mr. Ryan entered the employ of the Counties Gas & Electric Co., now a part of the Philadelphia Co. system, in 1924, and was made division superintendent of the Main Line division in 1928. With the exception of a brief period in a similar capacity in the eastern division at Jenkintown, he had been continuously identified with the company's activities in the Main Line area. Mr. Ryan was 54 years old.

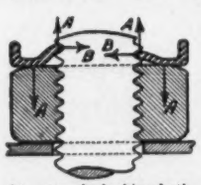
Shown is a Type "TTR" Vertical Break Switch, rated at 37,000 volts, 1200 amperes, made by Railway & Industrial Engineering Co., for years users of PALNUTS on their equipment.

THEY ARE *Double-Locked* WITH PALNUTS!

Many leading makers of indoor and outdoor switches use Double-Locking PALNUTS to assure permanently tight connections. They know from experience that PALNUTS stay locked under severest vibration, eliminating danger of overheating and corrosion at contact surfaces.

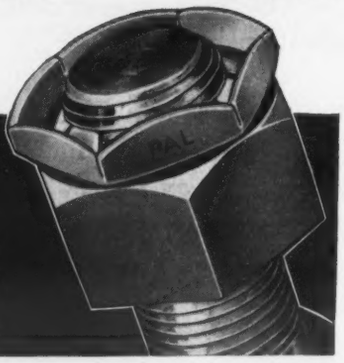
PALNUTS are single thread locknuts, either made of spring tempered steel for use on steel bolts, or made of resilient duronze for use on non-ferrous bolts exposed to the weather. They are easily, quickly applied on top of the regular nut, requiring but 2 full bolt threads. They are very low in cost and may be re-used. The unfailing security of PALNUTS has given them wide application on wood pole lines, steel transmission towers, transformers, bus fittings, connectors, disconnects, substation and other electrical equipment. Specify PALNUTS! Available from stock for all utility requirements. Write for Palnut Manual No. 1.

Double-Locking Action

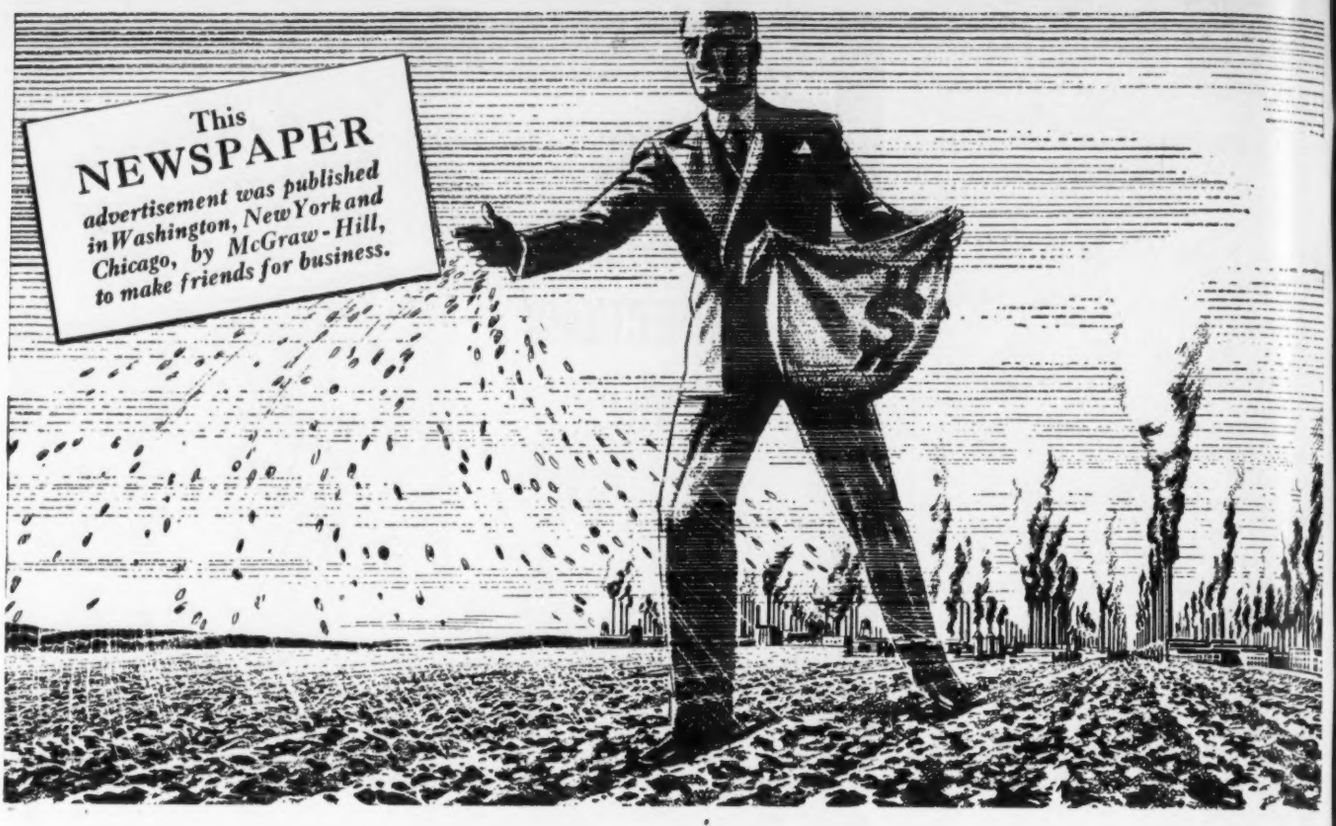


When the PALNUT is wrench-tightened, its arched, slotted jaws grip the bolt like a chuck (B-B), while spring tension is exerted upward on the bolt thread and downward on the regular nut (A-A), securely locking both.

THE PALNUT COMPANY
51 Cordier St. Irvington, N. J.



DOUBLE-LOCKING PALNUTS



Where do jobs come from?

SOMEDAY 10 million fighters, 2 million government workers and 10 or 15 million war workers are going to be asking: "Where can I find a JOB?"

The best answer will be a job for every questioner.

► The first step toward creating more jobs after the war should be to make sure that business has enough "Seed Money"* left over after taxes to grow a better crop of products and markets.

We have published some advertisements urging that the excess profits tax law be amended to let business keep enough of its "Seed Money" to convert its plants and start things rolling after the war.

► A proof of one of these "Seed Money" advertisements was sent to a man who lives up in Lowell, Mass. In reply, he wrote from his own experience such a good example of the way in which "Seed Money" creates jobs that we want you to have a chance to read it. Here it is:

Reprints of this advertisement are available in handy booklet form.

Where do jobs come from? (*Cont'd*)

December 23, 1942

Mr. James H. McGraw, Jr.
McGraw-Hill Building
330 West 42nd Street
New York, N. Y.

Dear Mr. McGraw:

Your esteemed favor of December 11 was duly received and contents noted carefully.

I can truly say that my business is completely a development of "Seed Money" and "Profit." I started a commission Wool and Noils carbonizing business in Woonsocket, Rhode Island in July 1909, with three men and one boy for the payment of whose three days' work the first week, I had to borrow $35.00 from a friend, because I had not earned one penny for six weeks before I undertook to go in business for myself. I had to operate without any financial assistance but with ample moral credit and a very favorable reputation built up at my business in working for other mills.

In two years' time I put back in the plant I was hiring a good part of my profits and what I had left I invested in a plant in Lowell and incorporated a company where I started in the Wool and Noils carbonizing with 13 employees with a payroll of $300.00 in January 1912.

Since then, practically all profits were ploughed back into the business gradually in new, modern machines and since two years have the largest wool scouring machine in the world, built by our men in our plant, employing now from 225 to 250 men, with a payroll which some weeks exceeds $10,000.00.

I have raised a family of two boys and two girls. The boys are now my associates. We own the business outright, no outsiders, also two of the 15 buildings we occupy.

Of course, I cannot say that I have made a fortune, for, all I possess is in plant and machinery, but, for all these years my business has been pretty steady. I have paid wages and salaries to many people and all that out of "Seed Money" and "Profit." For many years I had a very hard, at times very discouraging struggle because of lack of working capital but I persevered, operating very economically and cautiously.

I founded the business which my two sons will continue and I hope successfully and moderately profitable.

I trust that others will write you similarly so that you will have plenty of facts and materials to carry on your campaign of education of the public.

With heartiest, best wishes of the season, I am

Sincerely yours,

JG:MNL James Gilet

• • •

Doesn't that letter make it clear that reinvested profit is the source of new jobs?

► Under the present excess profits law, very little "Seed Money" can be saved for reinvestment after the war.

Isn't it about time for post-war planning to get down to the simple facts of good living?

► Men like James Gilet can keep this country at work, if legislators will make up their minds that good business is the source of all good living.

The mail that Congressmen get is their best contact with the people they represent. Write your Congressman and ask him to help in adjusting the law that takes away the "Seed Money" of business, and to review all laws with this principle in mind:

"What's Good for Business is Good for Americans"

THE McGRAW-HILL NETWORK OF INDUSTRIAL COMMUNICATION

22 publications, which gather "war-news" from the "war-production-front" through a staff of 153 editors and 725 engineer-correspondents . . . More than 1,500,000 executives, designers, production men and distributors use the editorial and advertising pages of these magazines to exchange ideas on war-production problems.

McGRAW-HILL BOOKS

Publishers of technical, engineering and business books for colleges, schools, and for business and industrial use.

*"Seed Money" is that part of profit which is held for reinvestment in a business to insure its growth.

McGRAW-HILL

PUBLISHING COMPANY, INC. . . . BOOK COMPANY, INC.

330 WEST 42ND STREET, NEW YORK

THE McGRAW-HILL NETWORK OF INDUSTRIAL COMMUNICATION:

American Machinist • Aviation • Bus Transportation • Business Week • Coal Age • Chemical & Metallurgical Engineering • Construction Methods • Electrical Contracting • Electrical Merchandising • Electrical West • Electrical World • Electronics • Engineering & Mining Journal • E. & M. J. Metal and Mineral Markets Engineering News-Record • Factory Management & Maintenance • Food Industries • Mill Supplies • Power • Product Engineering • Textile World • Wholesaler's Salesman • Affiliated with Business Publishers International Corporation, publishers of Business and Technical Magazines for Latin America, and Overseas Circulation.

MANUFACTURING-MARKETS

Sees Active Market in Post-War Era

A reservoir of demand for machinery and electrical equipment is being built up which should assure an active market during the post-war period, C. F. Poirier, general sales manager of the Crocker-Wheeler division of the Joshua Hendy Iron Works, recently declared.

Despite heavy production of machine tools and electrical equipment for the war, studies already completed indicate that machinery is wearing out in many plants and is not being replaced, Mr. Poirier said. Low priority ratings prevent such replacements even in many plants which are active in war production, he said.

Aside from such obsolescence, the development of new industries such as plastics, synthetic rubber and food processing, Mr. Poirier said, were expected to contribute to the post-war demand for generators, motors and other electrical equipment.

"We feel," said Mr. Poirier, "that our peacetime conversion problem is primarily one of sales and distribution engineering, rather than one of calling for the reconversion and retooling of plants, and the redesigning of products, such as will face the majority of war industries. By new methods of distribution, we hope to get our products into the hands of our customers at lower cost, and thus widen the prospective market by a planned sales effort . . ."

•

Foster Wheeler Shows New Output Record

Shipments by Foster Wheeler Corp. increased steadily throughout 1942 as new facilities were brought into operation, and the total volume for the year was in excess of $50,000,000. This compares with $24,286,104 of gross sales in 1941, and with a normal, pre-war business of $10,000,000 to $12,000,000 annually.

At the end of 1942 Foster Wheeler had unfilled orders of roughly $100,000,000, which compared with $59,000,000 on December 31, 1941. All of the company's work is now for defense, either directly or indirectly.

The company readjusted its capital last year, exchanging six shares of new $25 preferred stock and two common shares for each share of the old $7 preferred stock.

•

Dividend in War Bonds

Stockholders of the Belden Manufacturing Co. assigned slightly more than 13 percent of their March quarterly dividend to the purchase of war bonds or stamps under the "war bond or cash" dividend plan started by the company last August, Whipple Jacobs, president, has announced.

G.E. Institute Issues Nutrition Guide

To meet an ever-increasing demand for a simple and instructive method for getting more and more war workers to eat the kind of foods that will help keep them healthy and on the job, the General Electric Consumers Institute at Bridgeport, Conn., announces publication of a Master Nutrition Guide.

This new manual is designed for use by industrial dietitians, home economists, school teachers, home demonstration agents and all others interested in spreading the gospel of good nutrition through group education.

Into the preparation of the Master Guide has gone months of experience gained by Miss Edwina H. Nolan and her staff of home economists who have conducted nutrition courses in factories, community centers, department stores, public utilities, etc. As a result the Master Guide contains information and

STUDY FOOD SITUATION—At one of the nutrition courses at the G. E. Consumers Institute at Bridgeport, Conn., wives of General Electric war workers view various types of food during a session on getting the most out of ration coupons

ONLY AN ELECTRICAL WHOLESALER COULD THUS SPEED WAR PRODUCTION

Emergency airfields glowed 52 days earlier

Wesco Made Special Light Standards and Shipped "Floods" to Icy Coast in 18 Days

A large airlines company was in dire need of sixteen 500 watt floodlights and portable, adjustable, special standards for lighting emergency landing fields in the foul weather of the frigid Northwest Coast. For 5 weeks an order had been placed with the manufacturer of the equipment. Word then came of a minimum 5 more weeks before delivery. The airlines company appealed to Wesco for help.

The local Wesco House responded at once—arranged for special floodlight standards and bases, supervised the necessary tapping, drilling and other machining, selected the floodlights from its own large stocks and started the entire shipment on its way North in 18 days.

The aptitude of Wesco men to render emergency services beyond the scope of routine duty is no accident. It is the result of years of training, experience and initiative. Now devoted to winning the war, Wesco's "know how" will be at the command of industry and commerce when peace returns to the world.

WESCO SPEEDS PRODUCTION

* A special heat-treating oven was needed immediately by a tank builder. With Wesco's aid, an oven was designed, built, wired, and on the job in 48 hours.
* Synthetic rubber plant gets needed material in 3 days from Wesco. Delivery from manufacturers meant a six to ten weeks delay.

WESCO SERVES BUSINESS

* By warehousing stocks in anticipation of customers' needs.
* By furnishing informative and technical data.
* By providing trained sales and engineering personnel.

Westinghouse Electric Supply Co.

150 VARICK STREET • • • NEW YORK, N.Y.

A NATIONAL DISTRIBUTING ORGANIZATION WITH 80 BRANCHES

plans on (a) how to present nutrition instruction which will get the story across in the factory and in the home; (b) how to build advance interest in nutrition schools, and (c) how to maintain audience interest for the length of the course.

The nutrition course offered in the Master Guide can be given over a period of either three or four weeks, and has already been successfully staged in several General Electric factories as well as utilities, department stores and an army ordnance plant. The course was reviewed by the nutrition division of the office of Defense Health and Welfare Services, Washington, D. C.

•

Manufacturers Issue Earnings Reports

Wagner Electric Corp. and subsidiaries report for the year ended December 31, 1942, profit of $1,549,067 after provision of $3,740,504 for federal, state and foreign income and excess profits taxes. This net includes $303,755 post-war tax credit refund, but does not take into account special reserves comprising $244,910 inventory overhead increase and $521,387 reserve for contingencies. After these special reserves net profit was $782,770 equal to $2 per share on 391,385 shares of capital stock. For year 1941, net profit after $3,114,273 income taxes and $526,816 special reserves was $1,427,795 or $3.65 a share.

Cutler-Hammer, Inc., in a preliminary report for the year ended December 31, 1942, subject to audit, shows a net income of $1,510,782 after depreciation, interest, federal income and excess profits taxes and provision of $1,250,000 for possible inventory losses and post-war adjustments. Net is equal to $2.29 a share on 659,998 shares of capital stock. This compares with a net income of $1,498,616, or $2.27 a share in the preceding year, when $250,000 was set aside for possible inventory losses. Income and excess profits taxes in 1942 amounted to $7,922,682, against $3,537,301 in 1941. Current assets as of Dec. 31, amounted to $17,580,259.

•

Gets $200,000,000 Credit

George H. Bucher, president of Westinghouse Electric & Manufacturing Co., has announced that the company has arranged for a $200,000,000 credit, the largest in its history, to finance war production contracts. Chase National Bank of New York will act as a clearing house for the 140 banks expected to make the loan. The Navy Department has agreed to guarantee 70 percent of the credit.

Field Reports on Business

Reports indicate that the volume of heavy construction is rapidly decreasing. Maintenance materials and parts continue active. Wiring supplies are in demand in connection with extensions to housing facilities in war work areas. Retail sales continued at a rapid pace, but have slackened somewhat.

CHICAGO

January business in Chicago summarized by the Chicago Association of Commerce, this week, shows the following changes compared with prevailing levels in January, 1943. Factory payrolls were up 23.1 percent, electric power production up 8.8 percent. Building contracts awarded, however, were off 51.7 percent, department stores sales off 3.0 percent. Carloadings were down 24.2 percent in January, '43, over last year.

Industrial construction in the Chicago area authorized during the first two months of 1943 represented an investment of $25,208,150, it was announced by the Chicago Association of Commerce.

Work on a $400,000 project to connect 132-kv. transmission lines of Wisconsin Electric Power Co., Milwaukee, and Public Service Co. of Northern Illinois as a war emergency measure is under way, it was announced in Milwaukee this week. The capacity of the interconnection is to be 80,000 kva. Interconnection was ordered by WPB.

Electrical construction permits issued for the week ended March 11 were 391, compared with 291 for last week and 303 for two weeks ago.

The volume of "heavy" construction is decreasing very rapidly in Chicago, but there is sufficient business in maintenance materials and parts to keep electrical wholesalers above water. If the much-discussed defense housing program develops in Chicago wholesalers are looking forward to a sharp upturn in business.

Buick Motor Division, General Motors Corporation—the aviation engine plant constructed in 1941 in the Chicago area and enlarged in 1942—is being further expanded. It will triple its output of airplane engines. Bodine Electric Co. has leased a third Chicago plant. All output will go to the armed forces.

NEW ENGLAND

Connecticut Light & Power Co. has built a new line by which its system can be tied into that of the Mystic Power Co., serving southeastern Connecticut and Rhode Island. Household electric revenues gained about 5 percent on the Connecticut Light & Power system in 1942. Transmission facilities have been strengthened between Devon and Waterbury and additional switching equipment installed at the Stevenson and Bunker Hill substations. Plans are being made to complete 807 miles of rural lines immediately after the war.

Wiring supplies should move more rapidly as a result of plans for extensions to housing facilities in war work areas. The FHA has approved immediate construction of 100 dormitory units and 60 family units at Houlton, Me. and 100 dormitory units for Southbridge, Mass. The FHA has called for bids for 25 buildings to be constructed at Easthampton, and 26 buildings at Chicopee, Mass.

Massachusetts manufacturers have been awarded sizable contracts for welders' goggles, storage batteries, radio apparatus and motor-driven ventilating units. The demand for capacitors is very strong. Bids have been submitted on 100 electric heaters by a Massachusetts manufacturer, 1,000 porcelain bases, an unspecified number of flashlights, by Connecticut manufacturers, and lead cable, magnet wire and friction tape by Massachusetts manufacturers. Recent infra-red installations include a 120-kw. set-up for a metal-working war plant in Massachusetts. Welding equipment manufacturers are well ahead of demand for units, but the call for welding rod continues very urgent. Deliveries of this material are improving.

NEW YORK

Retail buying continued at a high pace during the week ended March 6, but showed some signs of slackening off from the record increases chalked up the two previous weeks. The Federal Reserve Board reported that department store sales for the latest week were 14 percent over the corresponding 1942 week nationally, and for the four-week period ended March 6 they were up 29 percent. The figures for the latest week show New York's gain at 14 percent, Boston's at 22 percent, Philadelphia's at 8, Cleveland's at 18 and Richmond's at 17 percent. During the same week specialty store sales were up 41 percent.

Civil engineering construction volume for the latest week amounted to $90,400,000—5 percent higher than the previous week, but 32 percent below the total for the corresponding 1942 week, according to *Engineering News-Record*. Current week's construction brings the 1942 total to $709,277,000—49 percent below the 11-week period of 1942. The month of February, however, climbed 35 percent over the January volume, which might be attributed to a seasonal pick-up, because the total was still 52 percent under last February.

PACIFIC COAST

High priority has been assured the necessary pole line material needed to connect up power plants now under construction in extreme northern California with existing lines. The new links might run as high as 220 kva., but would be mainly by wooden poles and crossarms, to conserve critical materials.

Out of the recent $1,442,000 appropriation to Moffett Field, Sunnyvale, Calif., about $300,000 will cover electrical material, of which $100,000 will be for a new local telephone system. The importance of marine material, both Navy standard and Maritime, to Pacific Coast electrical industry and local small industrials may be gauged by the fact that an even 70 ships were delivered by coast yards during February. Puget Sound Power & Light Co. is making extensive additions and installations in its Canal station in Seattle.

Varied electrical orders cover 100 welding sets, costing $48,000; motor-generator sets and cable controls, totaling $65,000 for Overseas base shipment, and a 5,000-hp. steel mill type motor complete with ventilating equipment, aggregating $700,000, for installation in southern California.

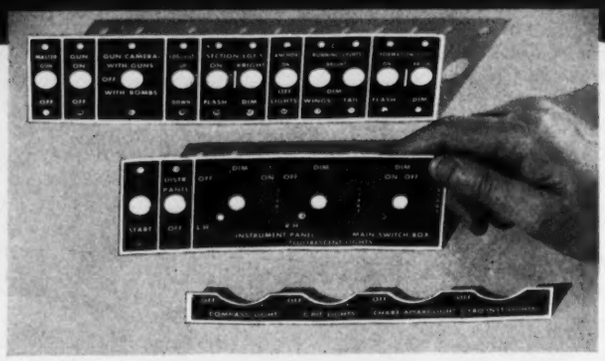
Oil and cement plants are operating at capacity, but lack of priority has cut electrical business from gold mines and lumber and other mills to a minimum.

Look at all 4 types of

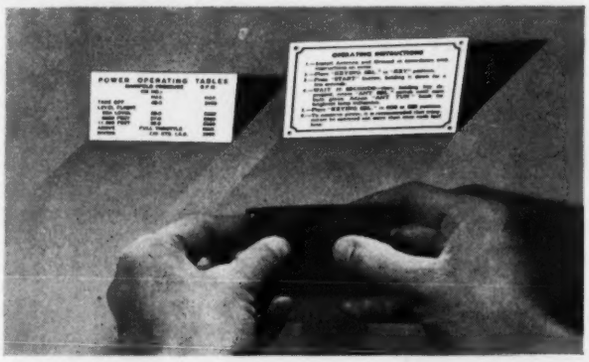
GRAPHIC LAMICOID

when specifying or designing equipment panels

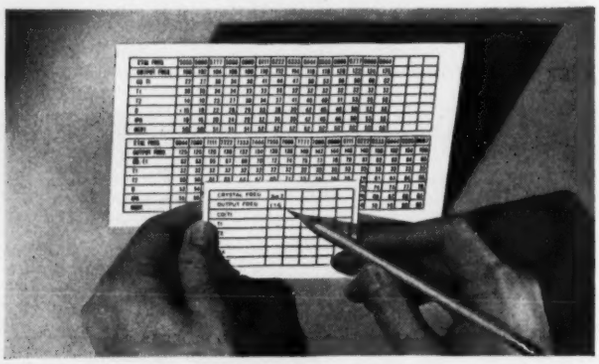
1 STANDARD — Printing, lettering, calibrations and designs are permanently bonded under the surface of this plastic resin sheet which has characteristics common to all four types: — Rich, permanent finish withstands moisture and handling: Tough and light in weight, yet readily drilled and machined.



2 FLUORESCENT — Sharp reproduction of fine detail is obtained with any of the fluorescent materials. They become an integral part of the sheet — not just a surface coat — and thus cannot chip or rub off during installation or in service.



3 FLEXIBLE — This semi-rigid sheet material is suitable for instruction or identification panels which must be attached to curved surfaces of equipment — or where serial numbers or other markings must be cold-stamped on the finished material.



4 GRAPHIC FINISH 2-D — This material was specially developed for panels containing charts, operating information and tabular data on which computations or temporary records must be made. The surface permits extremely legible writing in pencil or ink and repeated erasures without wear on the material.

IT'S EASY to see why thousands of designers have switched to Graphic Lamicoid for instruction and identification panels. They get an economical method for obtaining quantity production of identical panels . . . a choice of four materials that assures the right characteristics and finish for each job . . . clean-cut lettering and legibility even in the smaller sizes . . . and a lustrous plastic resin finish that prevents fading or obliteration.

See how the four types summarized and illustrated above are serving war contractors today. Then investigate how Graphic Lamicoid will meet your requirements — by sending samples or blueprints of the panels you need. We will quote prices on any quantity promptly, without obligation.

MICA INSULATOR CO., Dept. 11, 200 Varick St., New York, N. Y.

We are sending samples or blueprints of our_____

Quote prices on quantities of_____

This is NOT an order.

*Name*_____

*Company*_____ *Title*_____

*Address*_____

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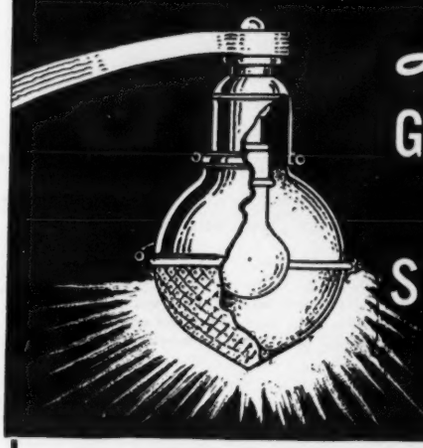

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Recent Rate Changes

SAN DIEGO GAS & ELECTRIC CO. has made electric rate reductions to the amount of $61,700 annually, effective February 15, with $59,000 of this amount being saved by military establishments and the balance of $2,700 by shipbuilders. Reductions were brought about after conferences between the utility, Walter Cooper, City Manager of San Diego, and representatives of the California Railroad Commission.

MASSACHUSETTS DEPARTMENT OF PUBLIC UTILITIES ruled during a recent hearing on New England Power Co. rates charged the Worcester Pressed Steel Co. that evidence presented by the latter as to prices paid and received by the Power company in contracts with other electric utilities has no value in determining the fairness of the price at issue in the industrial case before the board. The volume of energy interchanged and its character as primary or dump power affect the costs involved, and have little or no bearing on the energy requirements of the industrial plant in the case under consideration. Very low increment power rates applying to interconnection practice represent salvage of energy otherwise unsold and perhaps wasted over dams under certain hydro conditions. These do not govern industrial power prices per se. The hearing will be resumed at Boston March 23.

PIKE COUNTY (PA.) LIGHT & POWER CO. has agreed to reduce electric rates to the extent that annual savings to 942 residential customers would aggregate approximately $2,950. The state Public Utility Commission has announced that it has, therefore, terminated its rate case against the company. The new tariff schedules are ordered filed effective for all electric service rendered on and after March 1. The proceeding was instituted in 1941, on the commission's own motion. During the last several months negotiations were held which resulted in the company agreeing to make the reduction.

FORT PIERCE, FLA., municipal electric plant has announced a 20 percent increase in rates, effective March 10. The city commission has authorized the application of a 20 percent surcharge on light and power bills, except to contract holders, on the basis that increased production, oil and labor costs make such an increase necessary. The city manager is to confer with contract holders, large users, in an effort to reach an agreement for amendment of the existing contract rates.

OWENSBORO (KY.) UTILITY COMMISSION has adopted an amended electric rate schedule, which, it is estimated, will save domestic consumers $40,000 to $50,000 a year. The reduction applies to consumers with separate meters for light and power. The new schedule became effective on March 1.

UTAH POWER & LIGHT CO. preferred-stock holders' committee has filed appeals with the state Public Service Commission and the Governor of the state, seeking protection of rights in any action that might be taken in connection with the rate valution hearings which were recently concluded (March 6, page 130). Following the hearings, questions were raised in Congress over the right and authority of the Federal Power Commission experts to participate. FPC Chairman Leland Olds testified at a committee hearing that commission personnel appeared as expert witnesses on invitation of the Utah commission.

Sales Opportunities

ILLINOIS—Jo-Carroll Electric Cooperative, Inc., Elizabeth, has approved plans for new power substation, to be used in connection with power supply from high-tension system of Interstate Light & Power Co., for distribution in parts of Jo Daviess and Carroll Counties. Work is scheduled to begin at once.

KENTUCKY—Tube-Turns, Inc., 224 East Broadway, Louisville, manufacturer of seamless drawn fittings for welding, etc., plans plant expansion for production for government, comprising group of new buildings, with installation of machinery and electrical equipment. Cost estimated about $6,525,000, with financing by Defense Plant Corp.

GEORGIA—Civil Aeronautics Authority, Washington, D. C., will carry out expansion in airport, including hangars, shops and other operating structures, with electrical equipment installation for lighting service. Also control station and other facilities. Fund of $1,000,000 has been arranged for entire project.

SOUTH DAKOTA—State Department of Education, Pierre, plans installation of new electric generating units and accessory equipment in power plants at State College, Brookings, and State University, Vermillion. Appropriations are being arranged by State Legislature.

NEW YORK—Fairchild Engine & Airplane Corp., 30 Rockefeller Plaza, New York, will carry out expansion in a plant for production for government, including installation of machinery and electrical equipment. Cost about $750,000, with financing by Defense Plant Corp. Proposed to begin work at early date.

MINNESOTA—Northern States Power Company, St. Paul, plans early rebuilding of local indoor-type power substation recently damaged by fire, with loss reported about $50,000.

ILLINOIS—Defense Plant Corp., Washington, D. C., is concluding contracts with five organizations for construction and operation of plants for production of grain alcohol at different locations. Each plant will comprise several large one and multi-story units for processing and production, and miscellaneous service, with machinery and electrical equipment for large output; power substation facilities will be provided. Entire program will cost approximately $10,000,000 and will be financed by Defense Plant Corp., noted.

FLORIDA—U. S. District Engineer Office, Jacksonville, has plans maturing for three large aircraft engine repair and maintenance shops, with machinery and electrical equipment installation. Cost reported about $1,000,000. Proposed to carry out work soon.

IOWA — Civil Aeronautics Authority, Washington, D. C., is completing plans for new airport, including hangars, shops and other structures, with electrical equipment installation for industrial and lighting service, including control house, etc. Cost estimated about $650,000. Bids are scheduled to be asked at early date.

MICHIGAN—Chrysler Corp., 341 Massachusetts Ave., Detroit, has contracted with government for expansion in a plant, with installation of machinery and electrical equipment for increased capacity. Cost estimated about $600,000, with financing by Defense Plant Corp. Work scheduled to proceed at early date.

TEXAS—New Era Electric Cooperative, Athens, plans early construction of primary and secondary lines in parts of four counties, totaling over 250 miles, with substation and service facilities. Cost estimated close to $264,000, with financing through REA. It is understood that a preference rating is being secured.

ILLINOIS—War Dept. has approved plans for new army general hospital, comprising large group of one and multi-story buildings. A power house will be built, as well as a refrigerating plant and other mechanical units. An air-conditioning system will be installed. Entire project will cost about $4,000,000, and will be supervised by U. S. District Engineer Office, Chicago.

UTAH—Columbia Steel Co., Russ Building, San Francisco, Calif., will carry out further expansion in mill, where a development program has been in progress for several months, with construction of additional buildings and installation of machinery and electrical equipment. Cost estimated about $3,300,000, with financing by Defense Plant Corp.

INDIANA—Bridgeport Brass Co., Bridgeport, Conn., has approved plans for addition to ordnance plant, comprising large one-story structure, with installation of machinery and electrical equipment for increased output. Cost estimated about $1,000,000, with financing by Defense Plant Corp. Erection contract has been awarded to Stone & Webster Engineering Corp., 49 Federal St., Boston, Mass., which will award sub-contracts for different branches of work at early date.

FLORIDA—Navy Dept., Washington, D. C., has authorized new auxiliary naval air station, comprising hangars, shops and other operating structures, with installation of electrical equipment for industrial and commercial service, including complete lighting system. Also control station and other electrical facilities. Entire project is reported to cost over $2,000,000, and will be supervised by Public Works Officer, Pensacola.

NORTH DAKOTA—R.S.R. Electric Cooperative, Inc., Milnor, will have plans prepared by Banister Engineering Co., 1586 University Ave., St. Paul, Minn., consulting engineer, for primary and secondary lines for system, totaling about 240 miles, with power substation facilities, service connections, etc. Entire program is reported to cost about $250,000. It is understood that a preference rating will be secured.

TEXAS—Taylor Refining Co., Taylor, refined oils and gasoline, has contracted with government for expansion in plant, including new production units and installation of machinery and equipment. Cost about $1,000,000, with financing by Defense Plant Corp. Proposed to carry out work soon.

ALABAMA—Civil Aeronautics Authority, Washington, D. C., has approved plans for new airport, including hangars, shops and auxiliary structures, with installation of electrical equipment for industrial and commercial service, including lighting system, control station, etc. Entire project will cost about $700,000. Work is scheduled to proceed at early date.

IOWA—City Council, Mount Vernon, plans installation of turbine pumping unit and accessories for municipal water system, replacing existing old equipment. Application has been made for a preference rating.

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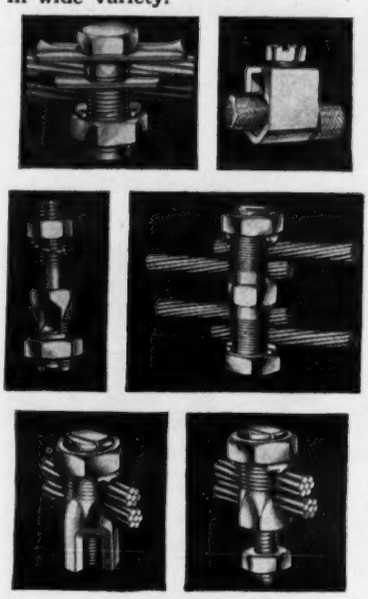

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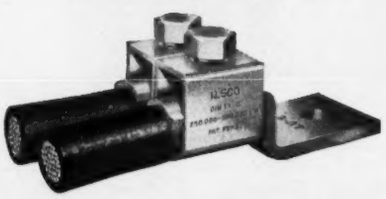

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LETTERS TO THE EDITOR

Spray-cool Formula

To the Editor of ELECTRICAL WORLD:

I have had several inquiries about equation 1 in the Montsinger-Ketchum article, "How Much Overload by Spray-Cooling Transformers," page 34, of the January 9, 1943, issue of ELECTRICAL WORLD. This equation is given incorrectly and should be:

$$\theta = \theta_e (1 - e^{-\frac{t}{B}})$$

This equation was given correctly when we sent it in, but for some reason or other the printer forgot to put in the minus sign, which made it appear that the small e is multiplied by $\frac{t}{B}$.

V. M. MONTSINGER,
General Electric Company,
Pittsfield, Mass.

•

Breaker Contact Temperatures

To the Editor of ELECTRICAL WORLD:

In the ELECTRICAL WORLD for February 6, 1943, in which a report is made of the discussion concerning "Guides for Application and Operation of Circuit Breakers and Switchgear" on page 51, it is stated that: "Further discussion of the committee report drew from F. R. Ford, Philadelphia Electric Company, the comment that tests show increases in breaker contact resistance of two to five times initial when operated at emergency total temperatures up to 90 deg. C." This quotation conveys a meaning directly opposite from that which was presented.

In the actual discussion given by me the point was made that during a normal maintenance period the contact resistance may increase two to five times. However, operation for a four-hour emergency period up to a maximum temperature of 90 deg. C. should result in a contact resistance increase of less than 30 percent, and this is negligible in comparison with the increase due to normal load. Thus, the point that I was making was that 90 deg. C. total temperature is entirely safe for emergency operation, and this was confirmed by the subsequent statement made by H. W. Collins of Detroit (referred to in the same paragraph of ELECTRICAL WORLD as Harold Cole), in which he pointed out that his company has adopted a circuit breaker contact temperature of 125 deg. C. for emergency operation.

In view of the fact that there has been considerable opposition to emergency temperatures above 70 deg. C. and that we have been using the 90 deg. C. figure on the Philadelphia system for several years, it is regrettable that the reported discussion in ELECTRICAL WORLD should give the opposite idea.

F. R. FORD,
Assistant Engineer—Inside Plant,
Electrical Engineering Division,
Philadelphia Electric Company.

[We are glad to rectify in this way the misinterpretation of Mr. Ford's remarks. —EDITOR.]

•

Recent Legislation

ARIZONA—A measure introduced in the legislature by Representative J. P. Martin would extend the scope of the municipal revenue act of 1940 to permit incorporated cities to issue bonds for purchase of power, water, gas, or other utility systems.

ARKANSAS—A bill that would permit Arkansas municipalities of the first and second class to issue bonds and purchase privately owned electric light plants operating in their limits has been given a favorable recommendation by the Senate corporation committee. The bill introduced by Senator W. L. Ward is similar to the one by Miss Alene Word, Mississippi County representative, which was defeated in the House recently (ELECTRICAL WORLD, March 6, page 68).

GEORGIA—Bill providing for a tax on utilities has been introduced in the House by Representative Casey Thigpen. It provides that the county ordinary or some other county official shall levy a tax of one cent per kilowatt-hour on all electricity consumed in the county. The tax would be passed on to the consumer and the dispensing company would be required to collect it and reimburse the county every three months. The money would be used for county purposes. A measure before the general assembly to permit the public acquisition and operation of properties of the Georgia Power & Light Co. in 21 south Georgia counties was killed recently at the request of its author, Senator J. W. Simmons of Bainbridge. Senator Simmons stated that he "decided that it was a dangerous bill in every respect and instead of benefitting the muncipalities interested in future years it would work a very great hardship and place the municipalities as well as the counties in a position that I do not believe they could carry out." Passage of the measure would have created a utility district empowered to own and operate waterworks and ice properties of the company, the management being under the direction of a board of three members.

ILLINOIS—Illinois Municipal League has announced that it will oppose a bill, which was recently introduced in the General Assembly, which would place city-owned electric, gas and water systems under the state Commerce Commission's jurisdiction. Only private utilities are now so regulated.

INDIANA—House of Representatives has passed by unanimous vote a bill which amends the utilities act to authorize the

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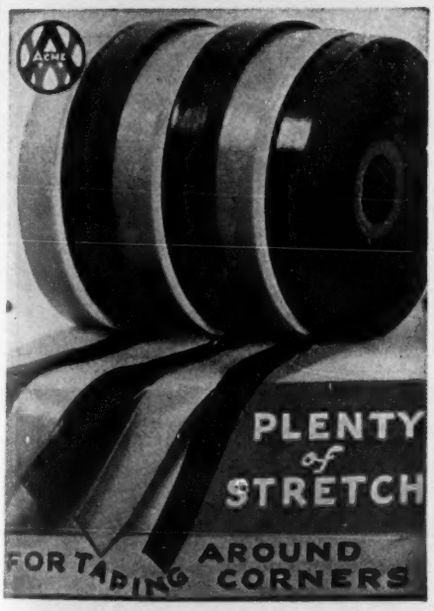

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board of directors for a municipally owned and operated utility to provide for an employees' retirement fund and permits investment of surplus retirement funds in purchase of retirement income contracts or retirement annuity contracts written by regularly licensed insurance companies. The bill carries an emergency clause and, if passed finally, would be in effect immediately on signature of the Governor. A bill in the House that required that, in the merger of two public utilities, employees of the selling corporation must be retained for four years by the buying corporation, has been withdrawn by its sponsor.

MISSOURI—Bill authorizing rural electrification co-operative associations to obtain perpetual co-operative charters, which was defeated in the state House on February 8, again was called up the following day, the adverse vote reconsidered, and the bill was passed. It was then sent to the Senate. The measure would eliminate the present 25-year limitation on the charters of such co-operatives, and place them on the same footing as privately owned utility companies as to charters. The bill was passed 92 to 43. The previous vote was 74 to 32, two votes short of the required majority of 76 for House passage. Representative Roy Hamlin of Hannibal, Democratic minority floor leader, who actively opposed the bill, asserted the legislature should not give the co-operatives, largely financed by REA, a perpetual corporate existence, in competition with privately owned utilities. He declared the co-operatives thereby would be perpetually exempted from taxation.

NEW YORK—Bills sponsored by the State Tax Commission, apparently intended to overcome the court of appeals decision in the case of the Adams Electric Light Co., wherein the court held that a transfer from earned surplus to no par value capital stock account is not a dividend within the meaning of the term as used in the tax law, have been introduced in the Senate by William Bewley, Republican, and in the Assembly by Maurice Whitney, Republican. The bills, Assembly Intro No. 695 Printed No. 734, and Senate Intro No. 563 Printed No. 780, have not as yet been reported. They apply to real estate corporations, transportation and transmission corporations, water works companies, steam heating, gas companies, lighting and power companies, and all business corporations. Section 186 of the tax law provides in addition to the one half of 1 percent tax on gross earnings, a 3 percent tax on dividends paid in excess of 4 percent on actual amount of paid-in capital used by a utility company. The above bills add the following words: "and the term 'dividend' includes any amount transferred from earned surplus to capital." This proposed legislation is regarded as objectionable because by transfer to capital from surplus, there is no enhancement in the value of the stock, nor any change made in the assets of the corporation. The corporation simply transfers from one pocket of the corporation to another pocket, in the process of bookkeeping certain of its own moneys. To make the stockholder subject to additional tax because of a shifting of funds on the corporation books is not regarded as a legitimate source of taxation.

NORTH CAROLINA—Senate finance committee has killed a bill permitting the City of Wilmington to acquire the property of the Tide Water Power Co., which operates in 18 eastern counties.

OHIO—House of Representatives has approved the bill by a vote of 111 to 13, to extend for two more years the 0.65 percent

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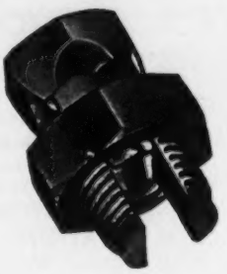

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tax on public utilities, which brings in approximately $2,300,000 annually, to be distributed to the counties for relief. The Senate is expected to approve the measure.

OREGON—Utilities committee of the House has asked the Legislature to require the state's municipally owned electric systems to pay 3 percent of their revenues to the general funds of their cities. The same committee introduced a memorial asking Congress to require payment of a portion of gross revenues in lieu of taxes by the Bonneville Power Administration to Oregon and Washington. Another substitute bill by the utilities committee would require rural electrification districts to pay a tax of 2 percent of their gross earnings. REA property already is taxed.

TENNESSEE—Senate has adopted, with an amendment, a bill introduced by Senator Grubb authorizing the state to pay to the municipalities tax replacement funds received from the TVA in lieu of local property taxes. The administration had opposed passage of the bill, as first drawn, contending that while the municipalities had lost taxes as a result of the public acquisition of power properties, the state also had suffered revenue losses and needed all the funds paid by the TVA to make up its own deficit. The amendment which Senator Grubb had adopted before obtaining Senate passage of his bill compromised the issue by providing that the state might pay to the municipalities only 50 percent of the amounts which would have been due if TVA had been authorized to make tax replacement payments direct to the municipalities.

TEXAS—Legislation is under consideration to establish a Red River Authority to operate the $54,000,000 Denison flood control and power project on the Red River, now nearing completion. The Authority would be set up along TVA lines.

•

Drops Rural Budget

Struck from acting Gov. Walter S. Goodland's recommended budget of $71,939,605 presented to the Wisconsin Legislature was the rural electrification co-ordination's $10,000 a year and the deep waterways commission's $3,500. In his message Mr. Goodland pledged that essential services would be retained, but indicated that "luxury" projects must go.

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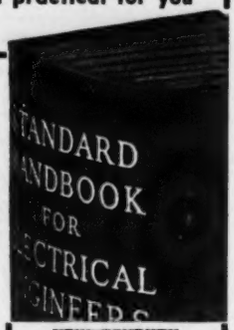

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2400/4160Y Volt Secondary Single Phase 60 Cycle with Oil

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with Curtis Turbine — recently reconditioned. Complete with voltage regulator, other switchboard instruments and Exciter. 100 lbs. G, 0° F S and 2" Back Pressure. Rating 500 K. W.—.8 P. F.—3 phase, 60 cycle, 240 volts. 4-Stage, Straight Condensing Worthington Spirojector Condenser.

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TRANSFORMERS WANTED

in operating condition or burnt out. Mail us list giving complete nameplate data and stating condition.

We Rewind, Repair and Redesign all Makes and Sizes
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"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M Since 1912 CINCINNATI, OHIO

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SURPLUS TRANSFORMERS

Don't scrap transformers. You can aid the War Effort by sending your list of surplus transformers to us. As we are one of the largest rebuilders and rewinders of transformers in the U. S. we can offer you top prices. Please give complete nameplate details and condition of transformer whether in operating condition or burnt out.

1893—Celebrating Our 50th Anniversary—1943

GREGORY ELECTRIC CO.
2636 S. WABASH CHICAGO

SUCCESSFUL OPERATION GUARANTEED

Every Machine in This Ad is Owned Outright By Us

D C MOTORS

	P	Make	Type	Volts	Speed
1—	1500	Whse.		550	330
3—	1250	G.E.	MPC	550	130
1—	800	G.E.	MPC	600	600
1—	625	G.E.	MPC	500	130
1—	600	G.E.	MPC	600	650/900
1—	600	Whse.		250	150/275
3—	350	G.E.	MPC	230	450
3—	300	G.E.	DMC	230	400/600
1—	300	Cr. Wh.	CMC	230	1150
1—	300	G.E.	MPC	230	275/550
1—	270	Whse.		500	250/400
1—	250	Al. Ch.		230	525
2—	200	Whse.		230	400
1—	175	Whse.	SK	250	150/525
7—	150	G.E.	RC-19A	230	800/1000
4—	150	Whse.	SK-201	230	300/900
1—	150	G.E.	MPC	230	250/450
1—	125	G.E.	CO-1832	230	625
3—	120	Whse.	SK-180	230	720
3—	100	G.E.	LC-50	230	1200
1—	100	Al. Ch.		230	950/1150
2—	100	G.E.	RC-19	230	575/720
1—	75	G.E.	LC	230	500/1000
1—	75	Whse.	SK	230	475/900
1—	60	El. Dy.	25S	230	525/1050
3—	50/60	Cr. Wh.	65H	230	500/1000
4—	50	G.E.	RC-16	230	650/815

TRANSFORMERS

	KVA	Make	PH	Type	Voltages
3—	1000	Pitts.	1	OISC	2300/4600x575
1—	1000	G.E.	1	HKDD	13800x2300
3—	300	G.E.	1	H	13200x2300/575
2—	200	Whse.	1	SK	6900x230/460
3—	200	G.E.	1	H	26400x115/460
3—	100	Whse.	1	OISC	13200x

GEAR UNITS

1—2100 HP Whse., 1800/375 RPM.
1—943 HP GE 5308/1200 RPM.
1—720 HP DeLaval 3600/600 RPM.

MOTOR GENERATOR SETS

3 ph. 60 cycle

1—1500 KW GE 600 V. DC, Gen. dc. to 2100 HP—6600 V. Syn. Motor with exciter.
1—500 KW GE 600 V. DC Gen. d.c. to 700 HP—2200/13200 V. Syn. Motor with Exciter.
2—250 KW GE 250 V. Gen. d.c. to 375 HP—2200 V. Syn. Motor.

TURBO GENERATOR SET

1—500 KW, Whse. 625 Kva., 440 V., 3 ph., 60 cy., 3600 RPM with Parsons 145/175 lb. condensing turbine complete with jet condenser and accessories.
1—500 KW, G.E., 625 KVA, 2300 V., 3 ph., 60 cy. generator with Curtis 4 stage, 150 pound condensing turbine complete with condenser, etc.

ROTARY CONVERTERS

60 cycle

2—1500 KW, Whse. 720 RPM 650 V. DC with 3-single phase, 33000 V. transformers and panel.
1—1250 KW, G.E. 720 RPM 250 V. DC with 1375 KVA, 3 ph., 2300 V. Transformers and Panels.
2—750 KW, Whse. 1200 RPM, 600 V. DC with 2300/6600/11,000 volts Transformers and Panels.
1—750 KW, Whse. 720 RPM 250 V. DC with three phase 6600/2300 V. Transformer and Panels.
1—375 KW, Whse. 1200 RPM 250/275 V. DC with 2200/6600 V. Transformers and Panels.
1—300 KW, G.E., type HCC, 1200 RPM, DC, 600 V. AC 6 ph., 1200 RPM.

25 cycle

3—1500 KW, G.E. 225/275 V. DC Booster type each with 1600 KVA 3 ph. 6765 volt Tranformers and Panels.
1—500 KW, G.E. 225/275 DC Booster type with 500 KVA 3 ph. 6765 volt Tranformer and Panels.

A. C. MOTORS

3 phase—60 cycles

Synchronous

	HP	Make	Type	Volts	Speed
1—	500	G.E.	TS	440	360
1—	250	G.E.	ATI	220	450
1—	225	G.E.	ATI	240	600
1—	200	Whse.		440	514
1—	150	G.E.	TRB	220x440	450
1—	150	Whse.	G	2300	900
1—	150	Whse.		2200/550	1800
1—	125	G.E.	ATI	240	257

Slip Ring

1—	800	Al. Ch.		440	885
1—	600	G.E.	IM	2200	900
1—	450	Whse.	CW	2200	875
1—	400	G.E.	MT	550/440	300
1—	400	Al. Ch.		2300	505
1—	400	Al. Ch.		440	1200
1—	350	G.E.	IM	2300/4000	257
1—	300	G.E.	IM	2300	585
1—	250	G.E.	MT-410	2300	400
1—	250	G.E.	MT	4000/2300	257
2—	200	Whse.	CW	2200	514

Squirrel Cage

1—	500	G.E.	1-17B	2200	695
1—	300	Whse.	CS	550	580
2—	300	G.E.	1K	2300	600
1—	300	Al. Ch.		2200	1160
1—	250	Al. Ch.		220/440	1150

SINE WAVE SET

Main unit—GE 3 unit, 4 Brg. consisting of motor—15/35 HP. 750/1800 RPM. 230 V. DC Gen—15 KW—220/110 V., 1800 RPM—3 ph., 60 cy.
Ref. Gen.—5 KW—36/18 V., 1800 RPM, 3 ph., 60 cy., with stator shifting.
Complete with Exciter Set, Voltage regulator, panels and accessories.

RE-NU-BILT BELYEA MOTORS

What are your requirements? units up to 5000 kw available in stock.

BELYEA COMPANY INC.

Main Office & Shop: 51 HOWELL ST., JERSEY CITY, N. J.

J. L. HEMPHILL & CO. Inc.

ELECTRICAL ENGINEERS AND EQUIPMENT
1600-1604 53rd Street, North Bergen, N. J.
N. Y. C. Tel.: LOngacre 5-3227—N. J. Tel.: UNion 3-2600

MOTORS GENERATOR SETS

1—35 KW, 125 volt Electric Machinery squirrel cage induction motor.
1—20 KW, 600 volt, General Electric squirrel cage induction motor.

MOTOR—3 PHASE 60 CYCLE

1—720 HP, 360 RPM, 440 volt, G.E., syn.
1—500 HP, 1200 RPM, 440 volt, G.E., syn.
1—400 HP, 514 RPM, 440 volt, Westg., slip ring.
1—335 HP, 600 RPM, 2300 volt, G.E., syn.
1—300 HP, 720 RPM, 2200 volt, G.E., sl. rg.
1—250 HP, 514 RPM, 4000 volt, G.E., syn.
1—250 HP, 600 RPM, 4000 volt, G.E., sync.
1—200 HP, 600 RPM, 2200 volt, G.E., sl. rg.
1—200 HP, 450 RPM, 2200/4000 v., G.E., sl. rg.
1—150 HP, 1800 RPM, 2300 volt, Al. Ch. sq. eg.
1—150 HP, 900 RPM, 440 volt, Al. Ch. sl. rg.

MOTORS—D. C. 230 VOLTS

2—450 HP, 400 RPM, General Electric MPL.
1—250 HP, 760 RPM, Electro Dynamic.
2—150 HP, 550 RPM, Westinghouse, SK.
1—150 HP, 750 RPM, Electro Dynamic.
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, G.E., 575 RPM.
1—100 HP, 625 RPM, G.E.
1—65 HP, 1000 RPM, G.E., type RC.
1—50 HP, 750 RPM, Westinghouse, type SK.

TRANSFORMERS

2—400 KVA, G.E., 4156-240/480 v., Scott taps.
3—300 KVA, Pittsburgh, 7800/440 volts.
3—250 KVA, Westinghouse, 5500/440 volts.
1—300 KVA, Pittsburgh, 7800-110/220 volts.
3—150 KVA, G.E., 33,000 2300/4000 Y.
1—150 KVA, G.E., 2400-120/240 volts.
3—100 KVA, Westinghouse, 11,430/250 volts.
1—100 KVA, Pittsburgh, 1375/2750-110/220 volts.
1—100 KVA, G.E., 2200-110/220 volts.
3—100 KVA, Westinghouse, 13200 250 volts.

MOTORS—VARIABLE SPEED 230 VOLTS

2—100 HP, 475/1375 RPM, Electro Dynamic.
1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electro Dynamic.
1—60 HP, 600/1200 RPM, General Electric.
1—35 HP, 500/1500 RPM, Westinghouse.
1—35 HP, 350/1050 RPM, Electro Dynamic.
1—30 HP, 225/900 RPM, Crocker Wheeler.
2—25 HP, 300/900 RPM, Electro Dynamic.
1—20 HP, 750/1500 RPM, General Electric.
1—15 HP, 300/1200 RPM, G.E.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker Wheeler.

ALTERNATORS

1—625 KVA, 3600 RPM, 600 volt, G.E.
1—400 KVA, 400 RPM, 240 volt, Westg.
1—250 KVA, 720 RPM, 230 volt, G.E.
1—200 KVA, 3600 RPM, 240 volt, Allis Chal.
1—62½ KVA, 3600 RPM, 220 volt, Allis Chalmers

TURBO-GENERATORS

600 KW, Terry dual bleeder condensing Turbine only.
1—500 KW, G.E., 3 ph., 60 cy., 480 volt, bleeder.
1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 volt, cond.
1—200 KW, G.E., 3 ph., 60 cy., 220 volt, cond.

ENGINE GENERATOR SETS

1—150 KVA, General Electric Generator, Ames uniflow engine.
1—62½ KVA, Westinghouse Generator, Fairbanks Company engine.

Complete Line of A.C. and D.C. Motors and Generators

CHECK OUR STOCK!

TRANSFORMERS
MOTORS
AC-DC—25 and 60 cy.

SPECIALS

2—500 HP Westinghouse Slip Ring Motors 3 PH. 60 cy. 440 V. 600 RPM.

1150 HP. G. E. Synchronous Motor 25/3/2200/375.

GENERATOR SETS
FREQUENCY CHANGERS
GENERATORS

SPECIALS

1—100 KW Motor Generator Set, Generator 220 V DC. Motor 3/25/2200 V.

ERIE ELECTRIC COMPANY
123 Church St., Buffalo, N.Y.

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Saving Maintenance WITH KLAMP-TITE SWITCHES

FIG. 1

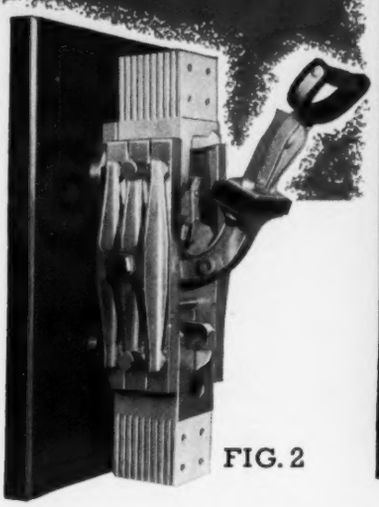

FIG. 2

FIG. 3

A 10,000 ampere, low-voltage Klamp-Tite in closed position, Fig. 1; in closing position, Fig. 2; and in fully-opened position, Fig. 3.

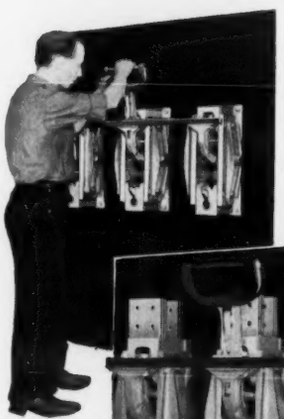

FIG. 4

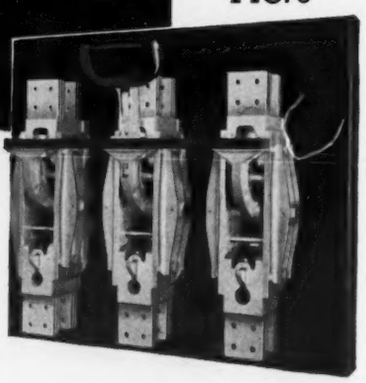

FIG. 5

Klamp-Tite Switches are of many types, for service from 1600 amperes up. Figs. 4 and 5 are of 5000 and 4000 ampere capacity, respectively.

WHEN a Klamp-Tite Switch is closed, contacts bear against terminals under thousands of pounds constant pressure. The surfaces, silvered and pressed together, can remain in closed position for years without maintenance.

In Klamp-Tite design, heavy bronze bars which produce positive contact pressure are located outside the current path where they are not subject to overheating and distortion.

The elements in conventional switches which make for frequent inspection and maintenance are entirely absent in Klamp-Tites. Consequently, Klamp-Tites can be depended upon to protect critical production schedules.

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*"Them gremlins" is correct according to Gremlinologists

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